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TRAILBLAZER INITIAL OPERATIONAL TEST AND EVALUATION: MANPRINT FINDINGS

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TRAILBLAZER SPECIAL PURPOSE DETECTING SYSTEM (AN/TSQ-138): MANPRINT FINDINGS

EXECUTIVE SUMMARY

Research Requirement:

The Trailblazer (AN/TSQ-138), previously designated AN/TSQ-114, is a ground based, division-level, computer-assisted communications-intelligence electronic support system designed to intercept target signals, determine their points of origin, and report the acquired information. The primary tactical targets are very high frequency, single channel, voice transmitters. Each Trailblazer system consists of five master control sets, each mounted on a M1015A1 track vehicle. The system is designed to interface with Quick Fix (EH-60A) and the Tactical Control and Analysis Center.

Prior operational testing occurred in 1978 and 1985, and an independent government test was conducted in 1988. During the 1978 test, the Fort Hood Field Unit of the Army Research Institute conducted a human factors evaluation of the Trailblazer operator-system interface, including equipment shelter, generator trailers, physical system setup, interface with electronics, and safety. The resulting report (ARI RR 1307C, Sep 1978) described 165 system shortcomings of varying importance.

Since 1978 the Trailblazer system has been modified extensively to correct some of the deficiencies of the AN/TSQ-114 model. The purpose of the research reported in this report was to answer three MANPRINT-related issues in the test design plan for the Initial Operational Test and Evaluation (IOTE) of the new Trailblazer version, AN/TSQ-138. The test was conducted by the Intelligence and Security Board of the U.S. Army Test and Experimentation Command at Fort Huachuca from 5 June to 28 July 1989. The three test issues of concern were:

a. Does the training support package prepare representative user personnel to employ, operate, and maintain the system in an operational environment?

b. Do safety or health aspects exist that may impact on the system employment or maintenance in an operational environment?

c. Does the system comply with human factors engineering principles?

Procedures:

Seventeen system operators received 80 hours of training during the period 24 April to 19 May 1990. Six maintainer personnel received 80 hours of unit level maintainer training followed by 80 hours of direct and general support maintenance training between 24 April and 22 May 1990.

ARI was enjoined from participating, officially, in the training evaluation, which was conducted by the new equipment training team (NETT) (two non-commissioned officers from the U.S. Army Intelligence School, Fort Devens). Nevertheless, ARI was able to collect, analyze, and report certain data pertaining to each of the MANPRINT-related issues. ARI data consisted of observations by ARI and INSBD test personnel, operator performance times for selected operational tasks, and operator and maintainer responses to structured interviews, rating scales and questionnaires.

Findings:

The MANPRINT findings fall into three major areas: training, human factors, and safety. The primary findings were:

a. The NETT stated that the training was adequate in preparing the soldier to "employ, operate, and maintain the system." It was determined by ARI, however, that no performance standards existed and no adequate list of critical tasks was available. Therefore, any conclusion regarding the adequacy of training must be considered subjective in nature. ARI identified several areas where the training could be significantly improved.

b. With regard to human factors, the current AN/TRQ is much improved over the earlier system. However, many human factors problems are still present and new problems have come into existence because of major system changes in hardware and configuration. There are significant exceptions to system compliance with human factors engineering principles.

c. Forty-three safety related factors were assigned estimated risk assessment codes (RAC) in accordance with AR 40-10. RACs ranged from 2 to 5, with an average of 3.7 on the 1 (highest risk) to 5 (lowest risk) scale.

Utilization:

The results of this research have been integrated into the overall INSBD test report of the Trailblazer initial operational test and evaluation (IOTE). and are to be used by the Army as input to design and production decisions.

CONTENTS

LIST OF TABLES

Trailblazer Special Purpose Detecting System (AN/TSQ-138): MANPRINT Findings

Introduction

This working paper presents the MANPRINT findings obtained by the U.S. Army Research Institute Fort Hood Field Unit during the Initial Operational Test and Evaluation (IOTE) of the Trailblazer system. The IOTE was conducted by the Test and Experimentation Command (TEXCOM) Intelligence and Security Board at Fort Huachuca during the period 5 June to 28 July 1989.

The Trailblazer Special-Purpose Detecting System (AN/TSQ-138, previously designated AN/TSQ-114) is a ground-based, division-level, computer-assisted communications-intelligence electronic support system designed to intercept target signals, determine their points of origin, and report the acquired information. The primary tactical target is very high frequency, single channel, voice transmitters. Each Trailblazer system consists of five master control sets, each mounted on a M1015A1 track vehicle. The system is designed to interface with QuickFix (EH-60A) and the Tactical Control and Analysis Center.

Development of Trailblazer was initiated by the Department of the Army in 1973. The program sponsor & materiel developer is the U.S. Army Materiel Command, Project Manager Signals Warfare. The combat developer is the U.S. Army Intelligence Center & School, Fort Huachuca. The user representative is the U.S. Army Training & Doctrine Command System Manager. At the time of this test, eight systems had been fielded in Europe, one in Korea, and one at the Intelligence School at Fort Devens. Another eight systems are to be fielded within TRADOC and FORSCOM.

Trailblazer is an evolving system. There are plans to mount it on a Bradley-type vehicle, a prototype of which (the Electronic Fighting Vehicle System) was undergoing concurrent testing during the present Trailblazer IOTE. In the future, Trailblazer will be integrated into a more encompassing system called Ground Based Common Sensor.

Prior operational testing of Trailblazer occurred in 1978 and 1985, and an independent government test was conducted in 1988. During the 1978 test, the U.S. Army Research Institute, Fort Hood Field Unit, conducted a human factors evaluation of the Trailblazer operator-system interface, including equipment shelter, generator trailers, physical system setup, interface with electronics, safety, etc. The ensuing ARI research report (1307C, September 1978) described in detail approximately 165 system shortcomings of varying importance. Among them were: unsafe generator trailers; inadequate storage and spatial arrangement of mission equipment; cumbersome and unsafe antennas; and a host of equipment-related findings concerning type, design, failure, usage, usefulness, quality, and convenience.

The TEXCOM Trailblazer IOTE was designed to avoid "contamination" by operator skill factors, and, therefore, allowed for very minimal collection of data that would be differentially sensitive to system operator performance, skills, or knowledge. However, the test directorate was cooperative in helping ARI work around this constraint to the extent possible, and some

progress in measuring these factors was achieved. The test design plan listed three critical issues related to MANPRINT:

1. Does the training support package prepare representative user personnel to employ, operate, and maintain the system in an operational environment?

2. Do safety or health aspects exist that may impact on the system employment or maintenance in an operational environment?

3. Does the system comply with human factors engineering principles?

ARI collected, analyzed, and reported data pertaining to these three test issues.

The MANPRINT findings presented fall into three major areas: training, human factors, and safety.

A MANPRINT evaluation report, emphasizing human factors, training, and safety factors was presented to the TEXCOM INSBD test directorate in Sep 89 for inclusion in the IOTE test report. This working paper presents the contents of that report in the format required by the directorate.

2.0 (U) TEST RESULTS

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2.7 (U) ISSUE 7. TRAINING

(U) Does the training support package (TSP) prepare representative user personnel to employ, operate, and maintain the AN/TSQ-138 system in an operational environment?

2.7.1 (U) Methodology.

2.7.1.1 (U) Operator and maintainer training for the IOTE was conducted by the new equipment training team (NETT), contracted by the Trailblazer project manager. The training was evaluated by the U.S. Army Intelligence School, Fort Devens [USAISD]. The evaluators were two subject matter experts in Trailblazer operations and maintenance, respectively. Operator training took place in two successive classes, eight students in the first and nine different students in the second, during the period 24 April to 19 May 1989. The course curriculum was the same for both classes and required approximately 80 hours of instruction. Maintainer training was presented in two separate courses, one for unit level maintenance, the other for direct and general support maintenance. Six maintainer students took both 80-hour courses between 24 April and 22 May 1989. Portions of the USAISD evaluators' reports, which are located in their entirety at Appendix A, are inserted or summarized below, as appropriate.

2.7.1.2 (U) Information supplemental to the USAISD training evaluation was obtained by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). An ARI research psychologist, was on site throughout the operator and maintenance training and portions of the IOTE field exercises. Data relevant to the training evaluation and to the training issue data requirements (DR) listed in the Trailblazer IOTE Test Design Plan (TDP) were obtained through: (a) observations of student testing procedures; (b) measurement of times required for operator performance of selected operational tasks; (c) detailed, structured and informal interviews of operators and maintainers prior to and during the field test; (d) subjective observations and assessments of operator performance during the test period; (e) administration of comprehensive questionnaires and rating scales to operators, maintainers, and instructors; and (f) subjective evaluation of the operator's manual TM 32-5811-902-10 and the maintenance manual TM 32-5811-902-20. The data are summarized here. Additional ARI data are provided at Appendix B.

2.7.2 (U) Criteria.

2.7.2.1 (U) Criterion. Following training, representative operators, supervisors, and maintenance personnel must be able to perform 100 percent of the tasks to required standards as specified in the TSP at least 90 percent of the time.

2.7.2.2 (U) Criterion. Training materials must be complete and accurate.

2.7.3 (U) Specific methodology.

2.7.3.1 (U) The test directorate evaluated the representativeness of operators, supervisors, and maintenance personnel through personnel data collected prior to the IOTE on all students who participated in the preparatory operator and maintainer training.

2.7.3.2 (U) ARI observed the details of the training test administrations in order to assess the subjective validity of the procedures and the extent to which objective performance standards were utilized. The percentages of operator and maintenance personnel who were able to perform as required by the IOTE test criteria are evaluated within this context, and the subjective estimates of the operators and the trainers themselves are provided.

2.7.3.2.1 (U) A 59-item, multiple-choice, written test was administered by the NETT trainer immediately following the two operator training classes. Two of the 59 items were subsequently voided by the trainer. A third item (#27) was eliminated by ARI in analyzing the data because there had been a wording change between administrations that gave an advantage to students in the second class.

2.7.3.2.2 (U) ARI also observed all of the final hands-on testing that occurred during a two-day period at the end of each of the operator training classes. Testing was conducted at an operational Trailblazer set located in the training compound. The amount of time required was approximately one and a half hours per student, varying from student to student. The examination attempted to simulate an actual mission, starting with site layout and continuing through setup, operations, and tear down procedures. Those parts of the exercise having to do with deployment, preparation for movement, and operating under unusual conditions were not, however, "hands on," owing to the impracticality of collecting performance data for these procedures. (Student knowledge of these areas was probed verbally by the trainer during the performance evaluation.)

2.7.3.2.3 (U) ARI examined the Training Record Sheets kept by the maintenance trainers for evidence of the use of viable training standards in connection with mid-course quizzes and practical exercises.

2.7.3.3 (U) In the interest of determining absolute performance indicators and providing data for use in the future development of Trailblazer training and performance standards, performance measures (times to complete tasks) were taken by ARI throughout the operators' final performance examinations. Other performance times were collected by the test directorate on system setup with and without personnel in MOPP-IV gear. These data were analyzed and summarized by ARI.

2.7.3.4 (U) To assess user attitudes and obtain user comments, suggestions, and criticisms of the training, a combination questionnaire and rating scale (the Trailblazer MANPRINT Evaluation Questionnaire) covering in detail a wide range of topics pertaining to the Trailblazer system was administered by ARI to all operators and maintainers at the end of the IOTE. In particular, the questionnaire contained two sections pertaining to Trailblazer training and training documentation. The scale data and pertinent soldiers remarks are summarized.

2.7.3.5 (U) Another ARI questionnaire (Trailblazer Questionnaire for Instructor Personnel), similar to the Trailblazer MANPRINT Evaluation Questionnaire, was completed by three Trailblazer operator instructors and three Trailblazer maintenance instructors. The data and the instructors' comments are summarized.

2.7.3.6 (U) Lists of required training and performance tasks were developed by the training evaluator and based upon training and system documentation. They are incorporated below.

2.7.4 (U) Results.

(U) This section provides data to answer the specific questions posed in the TDP. The questions are organized here into four general topic areas and listed in Table 2.7(1). The TDP DRs associated (in the TDP) with each question are shown in parentheses. The results presentation, which follows, is organized into four general sections corresponding to those in the table. However, for logical considerations and to avoid needless repetition, the discussion of specific DRs in the results is not always in conjunction with the associated topic area shown in Table 2.7(1); rather, a specific DR may be addressed in connection within the results presentation for a different topic area. For example, DR 2.7.3.2.1.1, which asks "What tasks are required to employ the system according to the training support package?" is addressed in the User Performance section.

TABLE 2.7(1) (U) QUESTIONS POSED BY THE TDP

	Personnel[a] data
TDP 2.7.3.1	What were the personal data for user personnel?
TDP 2.7.3.1.1	What were the personal data for operators and supervisors used during the test? (DRs 2.7.3.1.1.1-10)
TDP 2.7.3.1.2	What are the personal data for maintainers and supervisors used during the test? (DRs 2.7.3.1.2.1-10)
	Training support package
TDP 2.7.3.2	Was the training support package complete in regard to system employment, operations, and maintenance?
TDP 2.7.3.2.1	Was the training support package complete in regard to system employment? (DRs 2.7.3.2.1.1-5)
TDP 2.7.3.2.2	Was the training support package complete in regard to system operation? (DRs 2.7.3.2.2.1-5)
TDP 2.7.3.2.3	Was the training support package complete in regard to system maintenance? (DRs 2.7.3.2.3.1-5)
	Training materials
TDP 2.7.3.2.4	Was training documentation complete? (DRs 2.7.3.2.4.1-3)
TDP 2.7.3.2.5	Were training aids/devices adequate? (DRs 2.7.3.2.5.1-4)
	User performance
TDP 2.7.3.2.6	What critical task was each operator able to perform? (DRs 2.7.3.2.6.1-4)
TDP 2.7.3.2.7	What critical task was each maintainer able to perform? (DRs 2.7.3.2.7.1-4)
TDP 2.7.3.2.8	What percentage of tasks can operator and maintenance personnel perform to the prescribed level? (DRs 2.7.3.2.8.1-8)

[a]The term "personal" is used in the TDP; the term "personnel" is substituted in this report.

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2.7.4.1 (U) Personnel data.

(U) The personnel data for operators (DRs 2.7.3.1.1.1-10) and maintainers (DRs 2.7.3.1.2.1-10) are presented in Tables 2.7(2) and (3), respectively.

TABLE 2.7(2) (U) PERSONNEL DATA FOR OPERATORS

MOS	Rnk	Time in MOS	Time in serv	Civ educ	Mil educ & date	Duty assignment	Trbz exper	Ht/Wgt/S/Ag/DH
98G40	SFC	84M	15Y5M	BA	ANCOC --	Training Developer	None	74/200/M/46/R
98G30	SSG	108M	10Y8M	3 yr coll	BNCOC 1988	Trbz Instrctr USAISD	1 Yr	66/145/F/29/R
98G30	SSG	89M[a]	8Y5M	AA	BNCOC --	Voice Collection	None	70/174/M/27/R
98G30	SSG	72M	11Y6M	1 yr coll	BNCOC 1989	Trbz Instrctr USAISD	Simu-lator	68/158/M/29/R
98G30	SSG	52M	8Y6M	AA	ANCOC 1987	Training Developer	None	74/170/M/28/L
98G30	SSG	52M	5Y9M	50 hr coll	BNCOC 1989	ECM, Squad Leader	None	71/181/M/29/R
98G20	SGT	84M	8Y6M	HS	BNCOC --	Operator 109th MI	None	72/185/M/31/R
98G20	SGT	36M	5Y0M	BS	PLDC 1987	Operator TSC (CEWI)	None	72/180/M/37/R
98G20	SGT	24M	3Y11M	HS	Basic --	Operator 109th MI	None	71/171/M/23/L
98G20	SGT	15M	3Y1M	1.5 yr coll	Basic --	Operator 107th MI	3 Mos B(V)1	72/180/M/23/R
98G20	SGT	5M	1Y0M	AS	Basic 1988	Operator TSC (CEWI)	None	71/175/M/24/R
98G10	SPC	46M	9Y5M	1.5 yr coll	PLDC 1989	Operator 109th MI	None	69/156/M/30/L
98G10	SPC	24M	3Y8M	1 sem coll	Basic 1985	Operator 107th MI	None	64/120/F/22/R
98G10	SPC	12M	3Y0M	3 yr coll	Basic --	Operator 109th MI	None	68/180/F/22/R
98G10	SPC	12M	2Y9M	1 sem coll	Basic 1986	Operator 107th MI	None	71/207/M/23/R
98G10	SPC	4M	1Y8M	HS	Basic --	Operator TSC (CEWI)	None	62/114/F/19/R
98G10	SPC	3M	1Y8M	HS	Basic 1989	Operator TSC (CEWI)	None	62/125/F/19/R

Note. In the table headings: MOS = Military Occupational Specialty; Rnk = Rank; serv = service; Civ = Civilian; educ = education; Mil = Military; Trbz = Trailblazer; exper = experience; Ht = Height; Wgt = Weight; S = Sex; Ag = Age; & DH = Dominant hand.

[a]This soldier took the operator's training course, but did not function as an operator during the field test portion of the IOTE.

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TABLE 2.7(3) (U) PERSONNEL DATA FOR MAINTAINERS

MOS	Rnk	Time in MOS	Time in serv	Civ educ	Mil educ & date	Duty assignment	Trbz exper	Ht/Wgt/S/Ag/DH
33T40	SFC	150M	12Y6M	HS	ANCOC --	Training Developer	None	72/200/M/32/R
33T30	SSG	72M	7Y3M	HS	BNCOC 1988	Elec Instrctr USAISD	None	71/175/M/29/R
33T20	SGT	66M	5Y6M	Some coll	PLDC 1987	EMF Foreman TSC (CEWI)	None	71/163/M/23/R
33T10	SPC	16M	2Y4M	AA	PLDC 1989	Repairman TSC (CEWI)	None	66/138/F/30/R
33T10	SPC	6M	5Y9M	HS	Basic 1984	Repairman 105th MI	None	68/160/M/23/R

Note. The abbreviation in the headings are explained at Table 2.7(2).

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2.7.4.2 (U) Training support package.

2.7.4.2.1 (U) Operators' assessments of their training.

2.7.4.2.1.1 (U) What were the comments of the operators and supervisors regarding the training of system employment (DR 2.7.3.2.1.4) and system operation (DR 2.7.3.2.2.4)? See Table 2.7(4), which summarizes operator comments obtained with the Trailblazer MANPRINT Evaluation Questionnaire. The Training Evaluation Report (Appendix A) cites the student course evaluation questionnaire administered by the instructors as a data source for this DR; no summarization of the student critiques is provided. A copy of the critiques is provided in Appendix B.

2.7.4.2.1.2 (U) Table 2.7(4) is a compendium of ratings and comments obtained from the students with the "Trailblazer MANPRINT Evaluation Questionnaire" at the end of the IOTE field test, when their accumulated Trailblazer experience was at its greatest. (A copy of the questionnaire and the complete presentation of results is at Appendix B.) The students rated many of the topics on the following 5-point scale:

Very good	Good	Borderline	Poor	Very Poor
1	2	3	4	5

Only those topics rated from "borderline to very poor" (i.e., greater than 2.5) or for which at least 50% of the students provided written comments, are included. In the table, the three-digit item number from the questionnaire is followed by the mean scale rating of the students who responded to the item. (Some of the topics were covered in the questionnaire as open ended questions; for them, no numerical ratings are shown.) Nearly all of the 15 students rated each of the items in the questionnaire; on the average, the ratings are based upon 14 respondents. The number of students entering written comments

for an item was typically fewer than the number who rated the item on the scale; hence the percentage of respondents providing comments is shown after the topic listing. This percentage does not reflect the number of respondents making any particular comment, but only the number of respondents providing any comment whatsoever. Non-substantive and approbative comments normally are not shown (the complete list of comments is contained in Appendix B). A synopsis of substantive comments follows each topic listing.

TABLE 2.7(4) (U) OPERATOR COMMENTS: TRAILBLAZER OPERATOR TRAINING

No.	Rtg	Topic [% responding with comments]: Gist of comments
024	3.2	Use of TRAINING TIME. [93%]: (a) Time wasted because of informality of training, because training not individualized, because had to wait around a lot for turn at computer. A split training shift be better. Save time with more hands on, less classroom training. (b) Extend training--it was "too much, too soon"--by including more hands on. Add more theory of operation & meaning of software terminology. Don't rush students. (c) Stress mission oriented issues; organize around mission, not the TM.
019	3.1	Training for TROUBLE-SHOOTING [73%]: (a) Minimal. At best, sufficient only for general background knowledge. Only trouble-shooting advice was to recycle power. With more trouble-shooting training, would avoid much downtime. Trouble-shooting material in manual too limited. No trouble-shooting guide/checklist available. No hands-on trouble-shooting training.
016	2.9	Training for SYSTEM DEPLOYMENT [47%]: (a) Training for ground rod driver insufficient. (b) Not taught to ensure clearance for tailgate or shelter door when parking in obstructed areas. (c) Lack of effective communication between those in charge & team leaders.
021	2.9	TRAINING PROCEDURES [93%]: (a) Trainers should be knowledgeable about intelligence field have good understanding of system functions--i.e, knowledge beyond lesson plans--the "why." (b) Too much detail on use of computer--just need to know enough to gist & DF. Too many specialized terms used by instructors. "Too much, too soon." Topics outlines would help students grasping material & know what to expect. (c) Time wasted waiting for computer availability. Too many people in shelter at one time. More hands on, less class time.
017	2.7	Training for SYSTEM OPERATION [67%]: (a) Limited explanation of concepts; taught to push buttons without "why." Trainers should have good knowledge of 98G field; cannot answer certain questions effectively. (b) Lot of time spent learning to link with a TCAE (TCAC) that was never used. Often unable to link sets, which made some topics difficult. (c) Three different sequences for circuit breakers taught; sequence should have been determined before training. (d) Some training occurred during test rather than during training period; e.g., to call up gist page during DF to see DF results. (e) Operator's manual presented as extra resource, not as viable training or trouble-shooting aid: Many problems encountered (forgetfulness, requirements for trouble-shooting, error messages, etc.) could have been ameliorated.
020	2.6	TRAINING MATERIALS, AIDS, & EQUIPMENT [73%]: (a) The unofficial operator's guide was not helpful; rather, it was an outline for trainers. Workbook unnecessary. Occasional conflicts between material & instructor's information. Didn't use much. (b) Most important tasks performed in crowded space where good view was impossible. (c) Best aid is hands on, of which there was plenty except for ground rod driver. (d) Need more field practice after class training is finished.

TABLE 2.7(4) (U) OPERATOR COMMENTS: TRAILBLAZER OPERATOR TRAINING
(Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
022	n/a	WHICH TOPICS OF INSTRUCTION OR CRITICAL TASKS WERE MOST DIFFICULT FOR YOU OR OTHER STUDENTS TO LEARN? WHY? HOW COULD THEY BE TAUGHT MORE EFFECTIVELY? [67%]: (a) Gist & report modes: "Not user friendly enough." Should be more like word processing. (b) Operation of carrier vehicle: "Needs to be trained separately." Detracted from system training, because not official part of course. (c) "Why can't the circuit breakers be in order?" (d) "Collective protection equipment: no hands-on training." (e) Operator maintenance [M1015A]: bad instructor. (f) Creating & sending messages: bad instructor. (g) Interoperability. (h) Initial lectures "pointlessly detailed"--included much information that couldn't be comprehended until subsequent hands on experience. (i) Practical exercises too informal, followed whim of instructor; need more structured agenda.
023	n/a	FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME WITHOUT ASSISTANCE? [53%]: [The mean response to this question, based on 14 of the 15 operators was 66%; the range was 10 to 100%.] (a) If tested immediately, 100%; without practice: in five days, 90 to 95%; in two weeks, 70 to 80%. (b) "Instructors lack of knowledge . . . left a lot of important questions hanging." (c) "A comprehensive grip of the concepts & details didn't come until a couple of weeks into the [field exercise]. There was a lot of transference & confusion of concepts & commands from one function to another because the training was rapid & didn't include [sufficient] reinforcement [&] review [to go] beyond initial understanding." (d) "Lack of time on the system (formal practical exercise)." (e) Problem-solving experiences should be distributed more equitably among students.
025	n/a	WHAT WAS THE MOST SERIOUS SHORTCOMING, IF ANY, ASSOCIATED WITH YOUR TRAILBLAZER TRAINING? WHY? [93%]: (a) 43% of respondents noted quality of trainers as the most serious training problem]: "Instructors' lack of experience in our career field." Instructors "were not 98G's; in fact, the majority . . . weren't even in military intelligence." "Problems with one of the instructors . . . who is probably working at a carwash by now." "The quality of trainers was very uneven." Instructor lacked "knowledge of overall DF mission technique." (b) "Inadequate maintenance support." "Poor maintenance training [for the M1015A]; we spent plenty of time on it, but it doesn't matter if you don't get hands on training where you can see and touch what you're reading about." (c) Lack of realism: Training should have been structured around requirements of real mission. "Systems should have been taken out to different sites instead of doing just a portion of the setup and tear down procedures in the same position every day." (f) Safety hazard: "Soldiers who had no previous experience with tracked vehicles were given only one day to learn & become proficient with the system carriers. This is a grave safety deficiency. (g) Severely limited instruction on carrier maintenance: "The AN/TSQ-138 [Trailblazer] is of no use when sitting in garrison on a broken vehicle." (h) "Spent too much time on little details." "Operators were hurried."

TABLE 2.7(4) (U) OPERATOR COMMENTS: TRAILBLAZER OPERATOR TRAINING
(Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
026	n/a	ARE THERE SOME GOOD TECHNIQUES YOU COULD SUGGEST FOR TRAILBLAZER TRAINING THAT WERE NOT USED? [60%]: (a) Better orientation & realism: "Set up a net & show the novice operators [at] the outset what will be expected of them." "Work mission-work under time pressure; the best way to learn something is when you have to know it." "More hands-on training, less classroom." Don't teach interrelated functions as isolated tasks; teach interrelationships. "Regarding things like fluid levels: The operators were never really taught what they were for. A dipstick that reads empty doesn't mean much if you don't know what that fluid does." Use "demonstrations & formalized practical exercises with a standardized result/solution." Need "one-on-one maintenance training [for the M1015A]." (b) "'Students helping students': This has been shown to be an effective learning technique" that benefits both student & instructor." "Utilize the [available] expertise . . . e.g., SSG [name] trains this system at Fort Devens but had to sit through the two weeks listening & keeping quiet." (c) Employ individualized instruction & move students from one group to another. Use split training shift so students are not "doing nothing, waiting to get on position."
027	n/a	WERE ANY ESPECIALLY GOOD TECHNIQUES USED THAT SHOULD BE RETAINED IN FUTURE TRAILBLAZER TRAINING? [73%]: [64% of the respondents stressed the importance of hands-on training.]
028	n/a	DO YOU THINK THAT, FOR THE PURPOSES OF TRAINING, STUDENTS WOULD BENEFIT IF EACH WERE REQUIRED TO ACT AS CREW CHIEF DURING SETUP AND TEAR DOWN PROCEDURES? [ ] No [ ] Yes WHY? [100%]: [40% voted "No"; 60% voted "Yes."] (a) Yes: "Not necessarily as crew chief, but . . . everyone should have the opportunity to perform all related subtasks." "Good as long as the students helped train each other . . . and were not tested or graded." Produces better system awareness, understanding, efficiency. (b) No: "It leads to problems when lower ranking soldiers are put in charge of higher ranking soldiers." Promote teamwork, not leadership. Rotate tasks, not authority.
029	n/a	DO YOU HAVE ANY OTHER COMMENTS OR SUGGESTIONS REGARDING TRAINING? WHAT WOULD YOU CHANGE IF COST WERE NOT A FACTOR? [80%]: (a) Better instructors: "I think that operators should be taught by other operators . . . [the civilian contractors] don't understand what [the] operator needs to know." "The Army should send potential Trailblazer operators to the F-20 course at Fort Devens where millions of dollars have been spent on a simulator which can train the internal operations of Trailblazer quicker [&] more efficiently, and where [students] can be trained by experienced senior NCOs who are also 98Gs." "An hour with some of the trainers was more beneficial than a day with others." Instructors should use "a more formal approach to [teaching] DF operations." (b) Would provide "one-on-one maintenance training [for the track]." Need more driver's training for the track. (c) Provide for more hands on, more computers; eliminate written evaluation; test as teams. "A mere talk through on an inoperable ground rod driver is more of a safety hazard than a for-your-information class. (d) Provide "actual [operator's manuals], not abbreviated handouts"; also need manuals for 30 kW generator,

TABLE 2.7(4) (U) OPERATOR COMMENTS: TRAILBLAZER OPERATOR TRAINING
(Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		M1015A track carrier, & all system components. (e) "I would . . . do away with the task, conditions, standards [approach], and the 'this is what we have covered at this time; you should be able to . . . . Are there any questions?' [approach]." This insults one's intelligence and is boring; it is "unnecessary to be so book specific & formatted." (f) Shorten course. (g) "Don't put so much pressure on students to rush!" (h) "Much unnecessary tension on my team" was created because there were not enough sets of MOPP gear to go around; consequently, one team member did not have to suit up in "110 degree weather."

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2.7.4.2.2 (U) Maintainers' assessments of their training.

2.7.4.2.2.1 (U) What were the comments of the maintainers and supervisors regarding the training of system maintenance (DR 2.7.3.2.3.4)? See Table 2.7(5), which summarizes maintainer comments obtained with the Trailblazer MANPRINT Evaluation Questionnaire. Again, the Training Evaluation Report (Appendix A) cites the student course evaluation questionnaire as a data source; copies of the student critiques are provided in Appendix B.

2.7.4.2.2.2 (U) The assessments of the maintainers are summarized in Table 2.7(5), which is formatted like the previous table.

TABLE 2.7(5) (U) MAINTAINER COMMENTS: TRAILBLAZER MAINTENANCE TRAINING

No.	Rtg	CI	Topic [% responding with comments]: Gist of comments
021	3.5		TRAINING PROCEDURES [100%]: [See also item 024.] (a) "Very poor--wasted time." Spend less time on operational procedures. Should take only 12 hours [vs. 32] to train 3-man teams on operations. (b) Inadequate training and hands on for trouble-shooting: Lack of spare line replaceable units, replacement cards, etc. precluded practicing trouble-shooting with realistic equipment bugs. (c) Instructors should be knowledgeable on system.
024	3.5		Use of TRAINING TIME [100%]: [See also item 021.] (a) Too much waiting time; course too long. Wasted time could have been used for training on antenna. (b) Accuracy of the training materials needs much improvement. "We spent (no lie) at least 20% of our training time correcting diagrams, flow charts, etc."
018	3.3		Training for SYSTEM MAINTENANCE [100%]: (a) Training incomplete: Very little or no training on antenna system, interoperations, or on tracing signals from shelter bulkhead to outside equipment. (b) No manuals available for training on M1015A or TSU. (c) Training schedule inefficient.
020	2.8		TRAINING MATERIALS, AIDS, & EQUIPMENT [50%]: (a) "Student handbooks & overhead slides redundant--it was almost all in the 10 & 20 manuals." (b) "Need hands on for antenna."
022	n/a		WHICH TOPICS OF INSTRUCTION OR CRITICAL TASKS WERE MOST DIFFICULT FOR YOU OR THE OTHER STUDENTS TO LEARN? WHY? HOW COULD THEY BE TAUGHT MORE EFFECTIVELY? [75%]: (a) None were difficult. (b) "Start-up procedure: It changed several times before one procedure was established."

TABLE 2.7(5) (U) MAINTAINER COMMENTS: TRAILBLAZER MAINTENANCE TRAINING (Continued)

No.	Rtg	CI	Topic [% responding with comments]: Gist of comments
023	n/a		FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME WITHOUT ASSISTANCE? [50%]: [The mean response to this question, based on the estimates of all four of the maintainers was 76%; the range was 50 to 95%.] (a) Not enough experience after training to achieve high percentage.
025	n/a		WHAT WAS THE MOST SERIOUS SHORTCOMING, IF ANY, ASSOCIATED WITH YOUR TRAILBLAZER TRAINING? WHY? [100%]: (a) "No antenna training." (b) The manuals: "Had it not been for the trainers showing us [the] mistakes . . . the manual[s] would have [been] more valuable as potty-training papers for your dog!!!" (c) Couldn't maintain interest, because it was so dragged out.
026	n/a		ARE THERE SOME GOOD TECHNIQUES YOU COULD SUGGEST FOR TRAILBLAZER TRAINING THAT WERE NOT USED? [50%]: (a) Include "antenna bugs by disconnecting RF cable at dipole or loosening ground at hockey pucks. This is a very common failure which was never mentioned during training." (b) Make quizzes "more realistic"--"instead of quizzes on where stuff is in the manual."
027	n/a		WERE ANY ESPECIALLY GOOD TECHNIQUES USED THAT SHOULD BE RETAINED IN FUTURE TRAILBLAZER TRAINING? [50%]: (a) "Practical trouble-shooting." (b) "Hands-on."
029	n/a		DO YOU HAVE ANY OTHER COMMENTS OR SUGGESTIONS REGARDING TRAINING? WHAT WOULD YOU CHANGE IF COST WERE NOT A FACTOR? [100%]: (a) Get "knowledgeable instructors." "Throw out student handbooks; use time for reading manuals instead of listening to mumbling instructor's lectures." (b) More realism: Even though students may not make actual system repairs during training, use opportunity to "let the students isolate faults that occur." Provide "more line replaceable units to [allow] more realistic faults during trouble-shooting." (c) Provide more training on antenna. (d) Ensure that "printed materials (schematics, block diagrams, etc.)" are correct; need great improvement. (d) Accelerate the course.

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2.7.4.2.3 (U) Instructors' assessments of training-related issues. The "Trailblazer Questionnaire for Instructor Personnel" (see Appendix B) posed many of the same topics to the instructors as were posed to their students. In addition, questions were asked that were pertinent only to instructors. Seven questionnaires were provided to the NETT supervisor to be completed by the supervisor, four operator instructors, and two maintenance instructors. Six questionnaires were belatedly returned: three from operator instructors; two from maintenance instructors, and one from a maintenance instructor who had not participated in the Trailblazer IOTE training. By and large their responses were not as cogent as those of their students; nevertheless, they contained some useful information.

2.7.4.2.3.1 (U) Instructor assessments of operator training. Table 2.7(6) summarizes the comments of three operator instructors about Trailblazer operator training. The training topics listed were covered in the questionnaire as open ended questions. Therefore no numerical ratings are shown.

TABLE 2.7(6) (U) INSTRUCTOR COMMENTS: TRAILBLAZER OPERATOR TRAINING

No.	Topic [% responding with comments]: Gist of comments
016	WAS THE ARMY COURSE TRAINING PACKAGE PROVIDED YOU COMPLETE AND ACCURATE IN REGARD TO (A) SYSTEM EMPLOYMENT, (B) SYSTEM OPERATION, AND (C) SYSTEM MAINTENANCE? [33%]: "No, because it is lacking in training material for the M1015A and the 30kW generator."
017	ARE THERE ANY IMPORTANT TRAILBLAZER TASKS (OPERATIONAL OR MAINTENANCE) FOR WHICH THE TRAINING MATERIALS ARE LESS THAN ADEQUATE? [67%]: (a) "Yes." Knowing little about "military intelligence, it is very hard to explain to a student who just came out of AIT and language school exactly what [his or her] job is in conjunction with the Trailblazer system." (b) "No."
018	HOW MANY OF YOUR STUDENTS WERE NOT WELL PREPARED FOR THE TRAILBLAZER COURSE THIS TIME? [100%]: (a) "Less than 5%," which is typical. (b) It is "typical" for prerequisites not to be met in "track driving skills [&] PMCS skills for track & generator."
019	WHICH TOPICS OF INSTRUCTION ARE THE MOST DIFFICULT TO GET ACROSS TO YOUR STUDENTS? [33%]: "Displaying & accessing LOBs & fixes," because of the difficulty of explaining "certain commands & subcommands & their usage."
020	WERE THERE ANY PARTICULAR CRITICAL TASKS THAT SOME OF THE STUDENTS FOUND DIFFICULT OR IMPOSSIBLE TO MASTER? [67%]: (a) The notion that the two operators at a set should operate as a team--"while one operator is DFing . . . the other could [be] gisting." (b) "None."
021	FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME? [100%]: (a) "70." (b) "90." (c) "100." "Anyone [who] can read & makes [the] effort can perform %100 [sic] all the time!"
022	DID YOUR STUDENTS HAVE ANY SIGNIFICANT COMPLAINTS, COMMENTS, OR SUGGESTIONS THAT YOU WOULD LIKE TO PASS ALONG? [67%] (a) They noted "equipment failures." (b) "None."
023	IF YOU HAD YOUR WAY AND COST CONSIDERATIONS WERE NOT A FACTOR, WHAT ASPECTS OF THE TRAINING WOULD YOU CHANGE? [100%]: (a) "Always limit the number of students to two per shelter." (b) "The CPE: Get rid of it; it's just a waste of time. It takes too long to set up; it's too heavy for the vehicle with the TSU hooked up; and [I'd] bet my last dollar that it's not guaranteed 100% safe." (c) "None."

TABLE 2.7(6) (U) INSTRUCTOR COMMENTS: TRAILBLAZER OPERATOR TRAINING (Continued)

No.	Topic [% responding with comments]: Gist of comments
024	DO YOU THINK THE SAME TRAINING COURSE SHOULD TAKE LESS TIME? MORE TIME? [67%]: (a) "Less," because the program of instruction that we have to follow "tends to drag certain lesson plans."
025	WHAT IS THE MOST SERIOUS SHORTCOMING ASSOCIATED WITH TRAILBLAZER TRAINING? [100%]: (a) "Training time is seriously impacted when the equipment is constantly not operating properly." (b) "Not enough hands on training for instructors."
026	ARE THERE SOME GOOD TECHNIQUES YOU USE THAT ARE NOT A PART OF THE "OFFICIAL" TRAINING PACKAGE THAT YOU THINK OUGHT TO BE? [67%]: Yes, these people should be thought of as "'human beings' and not just as 'soldiers' or 'students.'" (b) "None."
027	WOULD THE INCORPORATION OF APPROPRIATE STUDENT PERFORMANCE STANDARDS IN THE TRAINING PACKAGE HELP TO ENHANCE THE TRAINING EFFORT? WOULD IT HELP TO IMPROVE STUDENT PERFORMANCE? [100%]: (a) "Yes, some students need as much motivational help as they can get." Yes, it would both enhance training & improve performance. (b) "No!"
028	WOULD THE PERFORMANCE OF OPERATORS DURING SYSTEM SETUP AND TEAR DOWN PROCEDURES BE ENHANCED BY INCORPORATING SOME CREW TRAINING INTO THE TRAINING PACKAGE--WHERE EACH STUDENT WOULD BE PROVIDE THE OPPORTUNITY TO ACT AS CREW CHIEF? [100%]: (a) "Yes," the experience would be good for them. (b) "Yes," we, ourselves, stress teamwork. (c) "No!"
029	WERE THERE ANY SPECIAL CONDITIONS (ENVIRONMENT, MAINTENANCE PROBLEMS, LOGISTICS, ETC.) ASSOCIATED WITH THE TRAINING AT FORT HUACHUCA THAT CAUSED YOU TO HAVE TO DEVIATE FROM THE PRESCRIBED TRAINING PROGRAM? [100%]: "Yes," equipment failures. Continuous equipment maintenance required.

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2.7.4.2.3.2 (U) Instructor assessments of maintenance training. Table 2.7(7) presents the assessments of the maintenance instructors. As in the previous table, no numerical ratings are shown.

TABLE 2.7(7) (U) INSTRUCTOR COMMENTS: TRAILBLAZER MAINTENANCE TRAINING

No.	Topic [% responding with comments]: Gist of comments
016	WAS THE ARMY COURSE TRAINING PACKAGE PROVIDED YOU COMPLETE AND ACCURATE IN REGARD TO (A) SYSTEM EMPLOYMENT, (B) SYSTEM OPERATION, AND (C) SYSTEM MAINTENANCE? [100%]: (a) "Yes." (b) "Adequate." Not enough manuals for M1015A, 30 kW generator, or TSU."
017	ARE THERE ANY IMPORTANT TRAILBLAZER TASKS (OPERATIONAL OR MAINTENANCE) FOR WHICH THE TRAINING MATERIALS ARE LESS THAN ADEQUATE? [100%]: "No." "Adequate."
018	HOW MANY OF YOUR STUDENTS WERE NOT WELL PREPARED FOR THE TRAILBLAZER COURSE THIS TIME? [100%]: "None." But "this was not a typical class . . . . They were very experienced . . . . Usually we have young troops."
019	WHICH TOPICS OF INSTRUCTION ARE THE MOST DIFFICULT TO GET ACROSS TO YOUR STUDENTS? [100%]: "None." Some just require more time than others.
020	WERE THERE ANY PARTICULAR CRITICAL TASKS THAT SOME OF THE STUDENTS FOUND DIFFICULT OR IMPOSSIBLE TO MASTER? [100%]: "No."
021	FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME? [100%]: (a) "85," based on experience. "An 'old head' should do much better, maybe 95%". (b) "100." (c) "100."
022	DID YOUR STUDENTS HAVE ANY SIGNIFICANT COMPLAINTS, COMMENTS, OR SUGGESTIONS THAT YOU WOULD LIKE TO PASS ALONG? [100%]: "The most common complaint among maintenance students is that there is too much emphasis on operations and not enough time for maintenance theory and practical [exercise]." (b) "No."
023	IF YOU HAD YOUR WAY AND COST CONSIDERATIONS WERE NOT A FACTOR, WHAT ASPECTS OF THE TRAINING WOULD YOU CHANGE? [100%]: (a) Maintenance lesson plans: "too repetitious"; "difficult to keep track of"; "quiz after every block is ridiculous and the students don't like them anymore than I do." (b) "Amount of hands-on time should be increased." (c) "No."
024	DO YOU THINK THE SAME TRAINING COURSE SHOULD TAKE LESS TIME? MORE TIME? [100%]: (a) Total length about right. (b) Devote smaller proportion to operations and larger proportion to maintenance.
025	WHAT IS THE MOST SERIOUS SHORTCOMING ASSOCIATED WITH TRAILBLAZER TRAINING? [100%]: (a) "Availability of equipment: The support packages are inadequate." "Frequent equipment failure causes training down time." When an operator training set breaks down, the maintenance training set is given up to operator training. (b) "Inadequate training space: On all fieldings we have been on, the maintenance classroom training space has been makeshift (except

TABLE 2.7(7) (U) INSTRUCTOR COMMENTS: TRAILBLAZER MAINTENANCE TRAINING (Continued)

No.	Topic [% responding with comments]:	Gist of comments
		at Fort Devens)." (c) "Army interference ([soldier] duties; lack of local support)."
026	ARE THERE SOME GOOD TECHNIQUES YOU USE THAT ARE NOT A PART OF THE "OFFICIAL" TRAINING PACKAGE THAT YOU THINK OUGHT TO BE? [100%]:	(a) "No." (b) "We are giving the 'straight skinny'; let's continue with that."
027	WOULD THE INCORPORATION OF APPROPRIATE STUDENT PERFORMANCE STANDARDS IN THE TRAINING PACKAGE HELP TO ENHANCE THE TRAINING EFFORT? WOULD IT HELP TO IMPROVE STUDENT PERFORMANCE? [100%]:	(a) Probably wouldn't hurt anything; let's try it. (b) "Perhaps." (c) "No."
029	WERE THERE ANY SPECIAL CONDITIONS (ENVIRONMENT, MAINTENANCE PROBLEMS, LOGISTICS, ETC.) ASSOCIATED WITH THE TRAINING AT FORT HUACHUCA THAT CAUSED YOU TO HAVE TO DEVIATE FROM THE PRESCRIBED TRAINING PROGRAM? [100%--see comment at end of paragraph]	"Yes, as always the maintenance course had to be juggled around to match the availability of equipment & systems to train on." Yes, "the usual equipment failures (air conditioning, TSU, etc.)." [The third respondent, who had not been at Fort Huachuca, said: "No, for Camp Casey, Korea."]

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2.7.4.2.4 (U) System shortfalls due to training. The TDP asks what system employment shortfalls (DR 2.7.3.2.1.3), operation shortfalls (DR 2.7.3.2.2.3), and maintenance shortfalls (DR 2.7.3.2.3.3) were noted by training evaluators during the test that could be attributed to training?

2.7.4.2.4.1 (U) The Training Evaluation Report (Appendix A) specifies that there were no system shortfalls noted by the training evaluators that were attributable to training.

2.7.4.2.4.2 (U) Among the system shortfalls due to training that were noted by the operators (Table 2.7(5)) were: (a) system downtime attributed to a lack of sufficient or adequate training for trouble-shooting, and (b) lack of skill or knowledge in operating the ground rod driver. A significant shortfall noted by the maintainers (Table 2.7(6)) was the implication of system downtime because of a lack of trouble-shooting training--most notably, for antenna group problems, problems associated with interoperations, and problems tracing signals from inside of the shelter to the outside.

2.7.4.2.5 (U) What additional training was required, if any, in order for operators and supervisors to properly employ (DR 2.7.3.2.1.5), operate (DR 2.7.3.2.2.5, and maintain (DR 2.7.3.2.3.5) the system?

2.7.4.2.5.1 (U) The Training Evaluation Report (Appendix A) lists three additional training requirements for proper operation of the system (DR 2.7.3.2.2.5): additional training on (a) system capabilities,

(b) doctrine, (c) and Trailblazer/Quickfix interoperability. The report states that no additional training is required for employment (DR 2.7.3.2.1.5) or maintenance (DR 2.7.3.2.3.5).

2.7.4.2.5.2 (U) Tables 2.7(4) and (5) indicate that both the operators and maintainers thought there should be more hands-on training in general and, in particular, more training in the area of trouble-shooting. The operators also stated a need for more training in (a) driving and maintaining the carrier vehicle (M1015A) and (b) the use of the ground rod driver.

2.7.4.3 (U) Training materials.

(U) The TDP inquires whether training documentation was complete and the training aids and devices adequate.

2.7.4.3.1 (U) The Training Evaluation Report (Appendix A) states that training documentation was complete and that training aids and devices were adequate, although exceptions in two areas were noted: inadequate determination of correct power-up/down procedures and no documentation for the tape recorder. It also specifies that training aids and devices listed in the lesson plans were used (DRs 2.7.3.2.5.1 & 2.7.3.2.5.2); that handouts were available (DR 2.7.3.2.4.1); that available manuals supported lesson materials (DR 2.7.3.2.4.2); and that there was adequate equipment available for hands-on training (DR 2.7.3.2.5.3). The comments and suggestions of the operators, maintainer, and instructors, however, make note of numerous shortcomings in these areas (DRs 2.7.3.2.5.2 & 2.7.3.2.5.4): (a) non-helpful student guide & handbook; (b) inadequate usage of the official operator's manual; (c) lack of manuals for the M1015A track vehicle, the 30 kW generator, and the trailer support unit; (d) inordinate number of errors in manuals, especially the maintenance manual; (e) lack of trouble-shooting information in the operator's manual; (f) inordinate number of midcourse quizzes; (g) need for great improvement in printed materials; (h) unneeded, redundant overhead slides; (i) insufficient number of system computers to allow adequate hands-on time for each student and to avoid making students wait; (j) unavailability of line replaceable units for use in trouble-shooting training; (k) inadequate availability of equipment due to continuous equipment failures; and (l) inadequate classroom area. (See Table 2.7(4), items 017, 019-024, 029; Table 2.7(5), items 018, 020, 021, 024-026, 029; Table 2.7(6), items 016, 022, 025, 029; & Table 2.7(7), items 016, 023, 025, 029).

2.7.4.3.2 (U) Assessment of the technical manuals.

(U) The TDP asks: "In the opinion of training evaluators and students, were technical manuals available, complete, and understandable?" (DR 2.7.3.2.4.3). The Training Evaluation Report (Appendix A) cites the student course evaluation questionnaire administered by the instructors as a data source for this DR. The report gives a "yes/no" answer to the question, which indicates that there was some shortcoming, but no summarization of the student critiques is provided. Copies of the student critiques are provided in Appendix B.

2.7.4.3.2.1 (U) Operator assessments of the operator's manual TM 32-5811-902-10. Table 2.7(8) is a compendium of ratings and comments obtained from

the students with the "Trailblazer MANPRINT Evaluation Questionnaire." (The format of the questionnaire is described at para 2.7.4.2.1.2)

TABLE 2.7(8) (U) OPERATOR COMMENTS: OPERATOR'S MANUAL (TM 32-5811-902-10)

No.	Rtg	Topic [% responding with comments]: Gist of comments
002	3.4	DURABILITY [73%]: Needs better binding; falls apart. Won't withstand adverse field conditions.
004	2.7	TABLES OF CONTENTS [47%]: (a) Poor organization; all contents should be at beginning of manual. (b) Never used contents pages.
006	2.6	READABILITY [27%]: (a) Poorly written; confusing, technical. (b) Poor illustrations; difficult to locate parts.
009	2.6	COMPLETENESS [33%]: (a) Needs better & more coverage of trouble-shooting. Needs section on interoperations. (b) Needs more explanation of "why." (c) Didn't use enough to know.
011	2.6	ILLUSTRATIONS [53%]: (a) Poor legibility; confusing. (b) More needed. (c) Need to be more informative in equipment description section of manual.
014	2.6	EASE OF USE as initial training document [53%]: (a) Initially, very hard to follow; hard to connect with reality. Assumes technical vocabulary of beginner. (b) Doesn't answer "whys" & "whats." (c) Okay, except for errors & required changes pages document. (d) Didn't use.
015	2.6	EASE OF USE as a reference document during operations or maintenance [60%]: (a) Insufficient index; inconsistencies in terminology. (b) Almost useless. Fair to good for experience operator. (c) Too bulky; no adequate reading space in shelter.
012	2.0	COMMAND SUMMARY [53%]: (a) Unaware of it; didn't use. (b) Poor logical arrangement. Make into two sections: basic memory aid & in-depth explanations. (c) Good, but has errors.

2.7.4.3.2.2 (U) Maintainer assessments of the maintenance manual TM 32-5811-902-10. The assessments of the maintainers are summarized in Table 2.7(9).

TABLE 2.7(9) (U) MAINTAINER COMMENTS:
MAINTENANCE MANUAL (TM 32-5811-902-20)

No.	Rtg	Topic [% responding with comments]: Gist of comments
013	3.8	ACCURACY [100%]: [See also items 009, 015, & 24.] "Many of the flow charts, wiring diagrams, & test jacks were mislabeled." "Accuracy of -20 manual okay, but -30 manual has many omissions on foldouts." Errors exist in specifications for cable connections & jack numbers.
002	3.5	DURABILITY [75%]: (a) Needs to be more durable, especially for field use; "Pages are always falling out." (b) "A lot of needless information in the beginning of the manual."
009	3.5	COMPLETENESS [75%]: (a) No maintenance information (wiring diagrams, etc.) included for antenna system. (b) Many cable numbers in manual do not corresponds to actual numbers on cables. Many jack & pin numbers are also incorrect or not listed.
015	3.0	EASE OF USE as a reference document during operations or maintenance [25%]: "Cable numbers, jack numbers, etc. are unreliable."
003	2.8	QUALITY OF REPRODUCTION [50%]: (a) Many illustrations blurred & illegible [see also item 011]. (b) Some mistakes found in diagrams.
010	2.8	APPROPRIATENESS OF CONTENTS [75%]: "Material in the beginning of the book [first two sections] was useless."
011	2.5	ILLUSTRATIONS [50%]: [See also item 003.] "Many illustrations are too small, [like] illustrating a needle in a haystack by showing us the whole farm!" Inaccurate & poorly reproduced.

2.7.4.3.2.3 (U) Instructor assessments of the operator's manual TM 32-5811-902-10. Table 2.7(10) summarizes the comments of three operator instructors about the operator's manual.

TABLE 2.7(10) (U) INSTRUCTOR COMMENTS:
OPERATOR'S MANUAL (TM 32-5811-902-10)

No.	Rtg	Topic [% responding with comments]: Gist of comments
002	3.3	DURABILITY as a field document [33%]: It will start to tear up after 3 or 4 months in the field.
011	3.0	ILLUSTRATIONS [33%]: Illustrations tend to be "hypothetical"; they don't always correspond to the real world.
004	2.7	TABLES OF CONTENTS [66%]: "Many of the operations students have difficulty using the table of contents. In order to find out why, I randomly chose items & used the table of contents to find them. I encountered no problems." Sometimes specific subjects cannot be found.
006	2.7	READING LEVEL 2.7 [33%]: For some students, trying to operate the equipment by following the manual was complicated.
007	2.7	LOGICAL FLOW OF MATERIAL throughout manual [33%]: Some things are not in the right places.
012	2.7	COMMAND SUMMARY [67%]: "Very helpful."
005	2.3	INDEX [67%]: (a) "No problem." (b) Specific topics cannot always be found.

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2.7.4.3.2.4 (U) Instructor assessments of the maintenance manual TM 32-5811-902-10). Table 2.7(11) presents the assessments of the maintenance instructors.

TABLE 2.7(11) (U) INSTRUCTOR COMMENTS: MAINTENANCE MANUAL (TM 32-5811-902-10)

No.	Rtg	Topic [% responding with comments]: Gist of comments
003	3.0	QUALITY OF REPRODUCTION [33%]: "Poor."
002	2.7	DURABILITY as a field document [67%]: Fold outs "get ripped out too easily." Ringbinder holes in the pages should be reinforced or a stronger page material used. "The Air Force uses a paper that is almost like plastic." Fine; will hold up if an appropriate binding is used.
009	2.7	COMPLETENESS [33%]: "Block diagrams, wiring diagrams have mistakes."
012	2.7	COMMAND SUMMARY [0%]:
013	n/a	MISTAKES [100%]: (a) "Submitted to Vint Hill [project manager]." (b) Have noted a very few "typing or editing" errors of "no consequence." However, the official changes we receive look like "rush jobs"--"for example, Change 1 to TM 32-5811-902-10, Appendix E, 'Error and Informational Messages,' has ink smears so bad you have problems reading it."

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2.7.4.3.2.5 (U) Miscellaneous observations pertaining to the Operator's Manual (TM 32-5811-902-20). These observations are based upon subjective evaluation by ARI and comments obtained from interviews with operators.

2.7.4.3.2.5.1 (U) The following list is meant to be illustrative. It contains descriptions of both large and small deficiencies that suggest both specific and general ways in which the manual could be improved. It is not intended to be a comprehensive documentation of the manual's deficiencies. The list is arranged by topic area.

Format

1. Has a thrown together, hand-made, appearance.
2. Manual does not take advantage of easy availability today of type styles & other techniques for laying out pages in an easy-to-read, easy to follow manner.
3. Does not make use of key words or headings at tops of pages for easy distinction of one section from another. Chapter II, for example contains 228 pages, consisting of four major sections. Two sections concern operating procedures; yet it is impossible to tell by looking at a page to what section it belongs.
4. Contains errors & other shortcomings. Examples: (a) Table of Contents (p. i) should begin on a new page. This comment stands on

its own, but is especially apropos when combined with the fact that the following page, on which the table is continued, is half empty. (b) Use of boxes on p. 1-21 illustrates a technique that could be put to advantage throughout manual, but isn't, & is not needed on this particular page.

5. Material that is not needed or very rarely need by an operator occupies a prominent place. Example: pp. 1-1 & 1-2, para 1-2 through 1-6.
6. Key pages are not marked or located for easy use. Examples: p. 1-10 (list of abbreviations) & p. 2-61 (operator task sequence).

Usage

7. The cover index, which has bars near right-hand edge with headings, is unusable. Corresponding bars on text pages are meant to be printed at very edge of pages so that reader can spot them while flipping through pages. Instead they appear approximately 1/4 inch from edge, which effectively hides them from view.
8. Has contents pages spread throughout the manual. They are difficult to find; some operators, in order to compensate wrote the pages numbers of the contents pages in the front of the manual.
9. Much needed cross references are wanting. Examples: (a) Table 1-1, a key table, should have page references for each item in list. (b) Page 1-26, para 4 (beginning with "Emitter activity") should be cross referenced to p. 2-128.
10. Non-optimal organization. Example: Chapter 2, Sections I ("Description and Use of Operator's Controls and Indicators"), II ("Preventive Maintenance Checks and Services"), III ("Operation under Usual Conditions"), & IV (Operation Under Unusual Conditions") would be more effectively reorganized as follows into four separate chapters: Section I becomes a chapter; Section II is combined with the setup procedures from section III to become another chapter. The operation procedures in Sections III & IV become a third chapter.

Content

11. Essentially useless pages: iv, vi, & vii.
12. Awkward terms. Example: p. 1-11, table of contents; the entry "Equipment Data" refers to what is normally indicated by the term "specifications."
13. "Trailblazer" is not an acronym, yet it is inappropriately typed in all capital letters each time it appears.
14. Unnecessary abbreviation in tables of contents. Example: p. 2-1, "RCDU" instead of "Receiver Control & Display Unit."
15. Overuse of abbreviations or acronyms. Example: The term "Quickfix," does not appear frequently enough to warrant use of "QF."
16. Textual redundancies. Example: p.1-28, paragraphs 2 ("An operator may also . . .") & 5 ("The operator may request . . .") say essentially same thing.
17. Undesirable use of possessive. Example: p.1-30, para 4, "system sets' DF data bases." Preferred would be "DF data bases of the system sets."
18. Confusion of terminology. Example: p. 1-31, bullets 1 & 2; normally, the two communication links are referred to as "data link" & "reporting link." Here they are both referred to as "data link."

19. Unexplained abbreviations or technical terms. Examples: p. 2-16, "NAV"; p. 2-37, "IF." One operator suggested that terms like "plasma," "histogram," "parameters," etc. cause temporary confusion to the student who is not already familiar with them.
20. Inconsistent use of terms. Example: p. 2.70, steps 3 & 6; circuit breaker is indicated by both "CIRCUIT BREAKER" & "CB," respectively.
21. Excessive use of warnings. Example: pp. 2-76 & 2-77, same warning (regarding hot exhaust stack) appears; p. 2-77, same warning (regarding hazardous RF energy) appears twice.
22. Unclear meaning. Examples: (a) Instructor comment: "The command summary in the back of the manual is not written clearly enough for students to understand. It should be written in layman's language." (b) The SHOW command explanation starting on p. F-18 is confusing. An improvement would list the command with all of its parameters at the beginning of the explanation, as follows: SHO [type] [start frequency] [stop frequency] [time] [point-distance] [unit designator].
23. Errors. Example: The EDIT subcommand SHOW displays fix data or gist message. The manual (p. F-18) states that if the command SHO is entered without specifying the optional data FIX or GI, fix data is displayed as a default. However, this is contradicted by a Fort Devens instructor, who maintains that the system will respond with instructions to type in the missing data.
24. Omissions and insufficient information. Examples: (a) To display fix or gist data, the normal procedure is to enter the command SHO G [or F] [frequency]. Then this takes about 14 seconds according to one measurement. However, if one enters the stop frequency (in this case the same as the start frequency), the result will be much quicker--normal screen response time. The latter method is not specified by the manual as the preferred method, but it should be. (See p. 2-188 & p. F-18.) (b) Pages 2-156 & 2-157; the manual tells the operator to set the band width and presents several choices, but gives no guidance regarding which one to set it to. (c) The manual discusses communicating between the shelter and the carrier cab (p. 2-195), and the shelter panel is illustrated (p. 2-16), but there is no mention of the intercom box in the cab nor of a TM that would describe its use. (d) The manual does not instruct the operator to remove the data link antenna "star" prior to movement, which appears necessary to avoid damage or loss; the procedure was taught during training. (e) Insufficient information on "immediate action" (e.g., no mention of reset button) for the air conditioning louvers, which apparently can close accidentally. (f) One of the trainers noted: "There are commands in the Command Summary at the back of the manual that are not up front in the manual; e.g., ACT [CR]." And "You can access assigned GIST files by paging forward from the unassigned files (the method used most frequently), but this is not indicated up front in the manual.

25. Needless repetition. Example: pp. 2-97 through 2-107 could easily be combined into one or two pages.

Illustration

26. Quality of reproduction is very poor--text in many illustrations is difficult or impossible to read.

27. Inadequate labeling of illustrations. Example: p. 206, no indication of which component is A19 & which is A20--a left/right correspondence must be assumed by reader.
28. Soldiers that use this manual (MOS 98G) have no need for cartoon-like illustrations as on DA Form 2028-2, which appears at back of manual, & on pages i & iv.
29. Lack of correspondence between text & illustration. Example: p. 2-60, reference is made to "cab operator"; the corresponding illustration (Figure 2-1, p. 2-61) identifies same person as "OPR 3."
30. Confusing illustrations. Example: p. 2-209.

Typographical shortcomings

31. Typographical errors/oversights. Examples: (a) On page i, table of contents entry for p. 1-11 should not be in boldface. (b) Page iii, which is a continuation of table of contents does not have words "TABLE OF CONTENTS - Continued" at top as does previous continuation page. (c) Page 2-13, megahertz is abbreviated both as MHZ & MHz; MHz is correct. (d) Page 2-38, "POWER guarded switch" should be "POWER (guarded switch)". (e) Page 2-156, in the Note, the word "in" should be "is." (f) Page 2-159, is it "autotune" or "auto tune"? (g) Page 2-188 middle left, the word "reports" should be "report."
32. Inaccurate & inconsistent illustration of plasma display. Example: pp. 151, 152, are the terms "MONITOR," "PRIORITY," & "NORMAL" supposed to be followed by colons or not?

Durability

33. The manual is reproduced on standard 8 1/2 x 11 paper lacks durability for use in field settings.

2.7.4.3.2.5.2 (U) Table 2.7(12) gives examples of index entries that one would expect to find in the manual, but does not. The list is not meant to be complete.

TABLE 2.7(12) (U) EXAMPLES OF KEY WORDS AND TERMS NOT IN THE INDEX

Autotune	Operator panel
BITE	PMCS
Call	Quickfix
CBs	RDLS
Circuit breakers	Reload
COMSEC equipment	Site
Disk memory unit	Support unit trailer
DMU	Trailer support unit
Filtered 120/208 VAC CBs	TSEC/KG-45 electronic key generator
Foot switch	
Headset	TSEC/KG-84A electronic key generator
Headset control	
IF	TSEC/KY-57 speech security equipment (Vinson)
IF Gain	
Inclinometers	TSU
Initialize	Unfiltered 120/208 VAC CBs
KY-57 (Vinson)	Unit designator
Leveler gauges	Vinson (TSEC/KY-57)
Lights switch	Weather conditions
Master caution	Zeroize

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2.7.4.4 (U) User performance.

(U) The basic TDP question here was whether there were critical tasks that operators and maintainers could not perform after training; and, further, what percentage of the tasks could they perform to prescribed levels?

2.7.4.4.1 (U) The following DRs from the TDP all pertain to operator and maintainer tasks:

What tasks are required to employ (DR 2.7.3.2.1.1), operate (DR 2.7.3.2.2.1), and maintain (DR 2.7.3.2.3.1) the system according to the training support package?

What tasks were trained to system operators, maintainers, and their supervisors in regard to system employment (DR 2.7.3.2.1.2)? system operations (DR 2.7.3.2.2.2)? system maintenance (DR 2.7.3.2.3.2)?

What critical tasks were required to be performed by the operator (DR 2.7.3.2.6.1)? the maintainer (DR 2.7.3.2.7.1)?

What critical tasks were performed by the operator (DR 2.7.3.2.6.2)? the maintainer (DR 2.7.3.2.7.2)?

What critical tasks were not performed by the operator (DR 2.7.3.2.6.3)? the maintainer (DR 2.7.3.2.7.3)?

Why did the operator (DR 2.7.3.2.6.4) / the maintainer (DR 2.7.3.2.7.4) state he was unable to perform the critical task?

What task was the operator required (DR 2.7.3.2.8.1) to perform? able to perform (DR 2.7.3.2.8.2)?

What task was the maintainer required to perform (DR 2.7.3.2.8.5)? able to perform (DR 2.7.3.2.8.6)?

What task was the operator (DR 2.7.3.2.8.3) / the maintainer (DR 2.7.3.2.8.7) unable to perform?

Why did the operator (DR 2.7.3.2.8.4) / the maintainer (DR 2.7.3.2.8.8) state he was unable to perform the task?

2.7.4.4.1.1 (U) The tasks that pertain to these data requirements are listed, as specified in the Training Evaluation Report (Appendix A), in Tables 2.7(13), (14), and (15). The report specifies that all the tasks were trained and that the operators and maintainers were able to perform all required tasks. The operators and maintainers, however, noted several instances in which important tasks were not trained or in which they either encountered extreme difficulty in performing or were unable to perform.

2.7.4.4.1.2 (U) Observations of operator performance by ARI confirmed that several operators were on several occasions unable to perform the required tasks unassisted within a reasonable amount of time. For example, when a team of two operators were requested by ARI to perform all normal setup and initializations procedures, numerous performance deficiencies were observed, among them the following: (a) Operator checked battery acid level with a bare finger; (b) the procedure for grounding the TSU and M1015A to the ground rod had to be looked up in the operator's manual; (c) operator was unaware of the release pin on the power cable spool and was unable to unwind the cable; (d) operator was unable to attach power cable to the trailer support unit properly (the retaining ring could not be engaged, and the operator did not know which way to turn the ring); the cable was left in position without being tightened down--the operator said "It doesn't really matter"; it fell out easily with a slight tug; (e) operator had practiced checking hydraulic fluid only once before (during training); (f) operators could not get the antenna group raised; they had no power and were unsure of the proper procedures for running the generator; (g) plasma scopes would not come on (appropriate switch settings had not been made); (h) both operators exhibited uncertainties about normal operational procedures and were uncertain about operational frequency ranges; (i) operator had great difficulty putting gist into a report--finally succeeded after consulting the operator's manual; (j) operators disagreed on the correct power-off sequence for the circuit breakers. Instances are also noted in the operators' comments summarized in Table 2.7(4) (see item 023) and noted or implied below in paragraphs 2.7.4.4.2.2.2-4, 2.7.4.4.2.2.5.3, and 2.7.4.4.2.2.6. (Additional discussion of this topic can be found under paragraph 2.8 (Issue 9. Human Factors).

2.7.4.4.1.3 (U) Interviews with maintainers revealed instances in which training was insufficient and in which they were unable to perform tasks

adequately: (a) "Training was inadequate on the OS-33 antenna--the main DF antenna. We have no way to solve the problems without guessing--no standard procedures for trouble-shooting the mounted antenna. Have been trying to solve one particular problem for three days. We have no wiring diagrams, or other information." (b) "Training did not give a good perspective on how system components interact with each other. We need a better understanding of what the BITE does, what components it tasks. The flowcharts are not sufficient." (c) "The training did not use realistic system faults. We need faulty equipment to work on. Perhaps 'paper' bugs would help." (d) "The training consisted of too much operator stuff--not enough in-depth maintenance training. We sat out there for a full day writing on the scratch pad and gist page--absolutely unnecessary! Why do I have to know how to edit gist files?--if the gist doesn't work, you swap the disk. We sat out there for two or three days pushing the DF button and tuning the receivers, taking LOBs--it's unnecessary--a waste of time." "[Altogether], we spent two weeks on the operator stuff, which should have taken three days."

2.7.4.4.1.4 (U) Hence, it is difficult, in the absence of adequate training standards, to determine that performance after training was at a desirable level. The operators, who stated that they had very little experience with some aspects of the system (e.g., the ground rod driver), estimated that one-third of the students could not, after training, perform all of the critical tasks with 90% reliability (see Table 2.7(4)). The maintainers (see Table 2.7(5)), who cited, among other things, a definite lack of knowledge about the antenna system, estimated that about one out of four students would not be able to perform all critical tasks with high reliability. The instructors were somewhat more generous--they estimated, on the average, 13% for their operator students and 5% for their maintenance students.

TABLE 2.7(13) (U) TASKS REQUIRED TO EMPLOY THE SYSTEM

1. Operate the ground rod driver.
2. Perform operator preventive maintenance checks & services on the master control set.
3. Perform operator preventive maintenance checks & services on the trailer support unit.
4. Prepare the trailer support unit for operations. (30 kW generator operation)
5. Prepare the master control set for power-on.
6. Power-on the master control set.
7. Deploy and stow the antenna group.
8. Power off the master control set.

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TABLE 2.7(14) (U) TASKS REQUIRED TO OPERATE THE SYSTEM

1. Initialize the master control set.
2. Set up communications equipment (voice, data & reporting links)
3. Initiate a directed search.
4. Initiate a general search.
5. Update directed & general search plans from a tasking message.
6. Intercept signals.
7. Edit fix & LOB displays.
8. Create a gist file.
9. Produce an outgoing message.

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TABLE 2.7(15) (U) TASKS REQUIRED TO MAINTAIN THE SYSTEM

1. Perform preventive maintenance checks & services on the master control set. (Organizational)
2. Determine the operational status of the master control set. (Organizational)
3. Troubleshoot the master control set. (Organizational)
4. Troubleshoot the interconnecting box in the master control set. (DS/GS)
5. Troubleshoot the analog-to-digital converter in the master control set. (DS/GS)
6. Troubleshoot the communications modem in the master control set. (DS/GS)
7. Troubleshoot the signal processor in the master control set. (DS/GS)

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2.7.4.4.2 (U) NETT evaluation of operator-students' performance.

2.7.4.4.2.1 (U) Operator's end-of-course written examination. (A copy of the instrument is at Appendix B.)

2.7.4.4.2.1.1 (U) The overall mean percent correct for both classes was 92.6. Considered separately, the classes were approximately equal: The mean percent correct for the first class (seven students) was 92.5; for the second class (nine students) it was 92.8. Individual student scores ranged from 87.7 to 98.2. (There were actually eight students in the first class; one did not take the final written examination, a fact ignored in his subsequent certification as a Trailblazer operator by the NETT.)

2.7.4.4.2.1.2 (U) Although the written examination itself can be considered an objective measure, there was no pre-established cutoff point (standard) below which a student would be given a "no go" for the course. The last item on the test (an item not included in the scoring) specifically indicated that the probability of any student's failing the test was "highly unlikely." All students were given "go's."

2.7.4.4.2.1.3 (U) Item analysis. Of the 56 test items, 27 (47%) were answered correctly by all 16 respondents. An additional 14 items were missed by no more than one student. Thus, 41 of the 56 items (73%) were answered correctly by at least 15 of the 16 students who took the test. Table 2.7(16) presents an analysis of the items. Those that were answered correctly by all students in both classes are not listed.

TABLE 2.7(16) (U) END-OF-COURSE EXAMINATION ITEM ANALYSIS

Item No.	% errors: 1st class (N = 7)	% errors: 2nd class (N = 9)	% errors: Both (N = 16)	Item No.	% errors: 1st class (N = 7)	% errors: 2nd class (N = 9)	% errors: Both (N = 16)
1	.	11.1	6.3	29	28.6	.	12.5
2	.	22.2	12.5	30	28.6	.	12.5
3	14.3	.	6.3	34	14.3	.	6.3
4	.	11.1	6.3	36	.	22.2	12.5
6	.	11.1	6.3	37	.	11.1	6.3
7	28.6	11.1	18.8	41	14.3	.	6.3
10	28.6	.	12.5	44	71.4	33.3	50.0
11	.	33.3	18.8	45	14.3	.	6.3
12	28.6	33.3	31.3	49	14.3	.	6.3
16	.	11.1	6.3	50	57.1	55.6	56.3
17	.	11.1	6.3	53	14.3	11.1	12.5
22	14.3	.	6.3	54	.	11.1	6.3
25	.	11.1	6.3	56	.	33.3	18.8
26	57.1	66.7	62.5				

Note. Zero percentages are shown by decimal points only.

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Examination of Table 2.7(16) reveals that the two operator training classes were quite similar in their responses to the written examination. The largest difference between classes for any of the 56 items was 38.1% (item 44), which is an indication that the training was consistent from the first class to the second. Items of particular interest are 26, 44, and 50, each of which were answered incorrectly by at least half of the students. The topics dealt with in those three items were: (a) the correct power switch status of the electronic key generator KG-84A for MCS power off; (b) the maximum number of LOBs per LOB set; and (c) manual calculation of the antenna heading during a fluxgate failure.

2.7.4.4.2.2 (U) End-of-course performance evaluation of operator students.

2.7.4.4.2.2.1 (U) Altogether, each student responded either verbally or by action to approximately 90 requirements during the evaluation. Thus the total number of requirements for the 17 students was approximately 1,530. Although ARI did not have access to the trainer's scoring sheets, in no instance during the testing was it apparent that a student received a "no go" for any of the

requirements. All of the students passed the examination regardless of level of performance.

2.7.4.4.2.2.2 (U) Subjectively, there were obvious differences in performance levels among the students. While the majority of the students performed adequately--in the sense that they were able to perform the majority of the tasks (however haltingly)--and the performance of a few appeared to be excellent, a few appeared to perform quite poorly. The poorest were not able to recall many of the required operational commands, procedures, or procedural sequences--especially involving operations within the shelter. They frequently referred either to the operator's manual or, more typically, to an unofficial operator's guide that had been provided by the trainer to each student at the beginning of the operator training course.

2.7.4.4.2.2.3 (U) Indications of the degree of validity of the testing methods used in Trailblazer NETT training are found in the observation that operator performance level (quality) often had for all practical purposes nothing to do with whether the performance was subsequently awarded a "go" or a "no go." For example, during the operator final performance evaluations, the trainer occasionally hurried over various requirements, stating the requirement and then "teasing out" an answer or an action by asking questions or making suggestions. The following is an particularly telling sample of trainer-student interaction:

Trainer: "Okay, we're now ready to send it [a message]. What do we do?"
Student: "Send it."
Trainer: "Right!"

(In this case, the trainer then gave the student a "go" on the procedure without requiring a demonstration of the procedure for sending the message.)

2.7.4.4.2.2.4 (U) It was typical to have the stymied student attempt to look up the proper procedure in the official operator's manual or in the unofficial operator's training guide. Frequently, the trainer would assist by giving page numbers or pointing out sections of text to the student. Also indicative, is a comment made by the trainer to several students during the final hands-on testing:

Trainer: "If you know how to find it in the book [manual or guide], you know how to do it."

In this particular instance, the student had <u>not</u> known how to perform the procedure and was therefore obliged to look it up in the manual. After the proper procedural instructions were located, a "go" was awarded by the trainer without the student's having to perform the task. The students were allowed to refer not only to the operator's manual, but also to the unofficial training guide provided by the trainer. (It is of interest to note that in only one instance during the performance testing was a student observed to make use of the "help file" available from the computer rather than resorting to the operator's manual or guide.) One student remarked, during an interview: "To say you can look it up in the manual is a good answer on paper, but it doesn't work in reality."

2.7.4.4.2.2.5 (U) Observation of a small sample (N = 13) of instances in which students used the unofficial guide (n = 7) or the official operator's manual (n = 6) to assist themselves through the performance evaluation revealed the following:

2.7.4.4.2.2.5.1 (U) The instructor gave the student one or more cues (page numbers, sections, etc.) to where the sought after information could be found in the guide or manual in 9 of the 13 instances observed. For the guide, cues were given in 3 of the 7 cases; for the manual, cues were given each time.

2.7.4.4.2.2.5.2 (U) The mean time required (cues included) for the student to locate the information in the guide was 33 seconds (range: 10 seconds to 1 minute). For the operator's manual the mean look-up time (cues included) was 1.4 minutes (range: 1.0 to 2.3 minutes).

2.7.4.4.2.2.5.3 (U) The information most frequently sought from the operator's manual (50% of the look-ups) was how to update directed and general search plans.

2.7.4.4.2.2.6 (U) There were a few instances in which the operator could not perform a required task because of the necessary strength requirements (e.g., releasing or seating the mast transport retaining fastener). At these times, the task was performed for them by the instructor or the evaluator. The inability of the student to perform the task was neither counted against the student nor the system, and a "go" was given without regard to the fact that the supposedly required performance had not occurred.

2.7.4.4.2.3 (U) Operator-instructor comments about performance measures. Two of three operator instructors offering written comments (Trailblazer Questionnaire for Instructor Personnel) related to the topic, expressed an interest in seeing "appropriate student performance standards" incorporated into the operator training package. The third instructor's comment was: "No!"

2.7.4.4.3 (U) NETT evaluation of maintenance students' performance. The maintenance instructors were required to complete a Training Record Sheet (TRS) for each of the six maintenance students. The TRS is a record of student performance throughout the training period, but does not cover the final written or performance evaluations. The TRSs indicated that the training consisted of seven segments on unit-level maintenance and eight segments on direct and general support maintenance. The TRSs also indicated that during training the students were tested with 37 quizzes and 51 practical exercises--a combined total of 528 tests of knowledge and skills, 88 per student. (According to the record, three students were not present for a total of 14 of the practical exercises, so the actual number of administered tests was 514.) The instructors were required to record (and initial) for each of the 514 tests the date of the test, whether the student was given a "go" or a "no go," and, if a "no go," the date and results of retesting. The TRSs show that on not one of the 514 tests was a student given a "no go" and that no retesting was done. Student comments (from training evaluation sheets administered by the instructors): "Tests too easy." "Half of the tests could have been eliminated." "Too many of the tests were repetitive."

2.7.4.4.4 (U) Determination of operational performance standards. The acquiring of adequate measures of performance level is dependent upon several

factors, among them the type of task, the conditions under which the task is performed, and the limitations of measuring techniques. Owing to such constraints it was not possible to obtain complete personnel performance level data on many aspects of system operations during the IOTE. Nevertheless, two sets of data were obtained: (a) the amount of time required for newly trained students to perform several sets of important operational tasks, and (b) the amount of time for operator crews of three persons to setup the system for operations in the field.

2.7.4.4.4.1 (U) Operator performance times during performance evaluation. Table 2.7(17) shows the mean number of minutes required to perform a subset of critical tasks required of the students during their performance evaluations. The data are presented for the two training classes separately and combined. The minimum and maximum performance times observed are shown, as is the number of performance samples (N) upon which the means are based. The task descriptions are taken directly from the trainer's performance evaluation checklist, a copy of which is provided in Appendix B.

TABLE 2.7(17) (U) PERFORMANCE TIMES FOR SELECTED OPERATIONAL TASKS

Task & subtask description	Training class	Mean time (min)	Range	N
1. Prepare & connect power source.	1st:	2.7	2.2-3.2	2
	2nd:	9.0	n/a	1
a. Perform PMCS on generator.	Both:	4.8	2.2-9.0	3
b. Connect power cable between TSU & shelter.				
2. Prepare MCS for power on.	1st:	0.8	0.4-1.6	5
	2nd:	0.7	0.5-1.0	4
a. Lights switches.	Both:	0.8	0.4-1.0	9
b. All filtered 120/208 VAC distribution CBs OFF.				
c. 28 VDC Main CB is OFF. All other 28 VDC distribution CBs on.				
d. Air conditioner control switch OFF.				
e. All unfiltered 120/208 VAC CBs behind distribution circuit breaker access door are OFF.				
f. Following power switches are ON:				
(1) Audio recorders.				
(2) Receiver control displays.				
(3) Signal data processor.				
(4) Voice link transceiver.				
(5) Plasma Displays.				
3. Power up shelter.	1st:	3.4	1.7-5.0	4
	2nd:	2.9	1.1-4.9	6
a. At power source, turn on power.	Both:	3.1	1.1-5.0	10
(1) Start/run/stop switch in the START position. Oil pressure gauge reads at least 30 PSI.				
(2) Circuit breaker switch in the CLOSE position until the circuit breaker indicator lights.				
(3) All engine & generator readings observed for proper voltage, oil pressure, frequency, etc.				
(4) All CBs behind access panel ON except for equipment not used. Access panel door closed & secure.				
b. Verify reading in shelter.				

TABLE 2.7(17) (U) PERFORMANCE TIMES FOR SELECTED OPERATIONAL TASKS
(Continued)

Task	Training class	Mean time (min)	Range	N
4. Power on MCS. a. Set switch S4. b. Set air conditioner controls. c. All filtered 120/208 VAC CBs turned ON in numerical sequence, except CB18. d. 28 VDC main ON. e. Reset/Test switches on caution panel reset one at a time. f. CB18 turned on after RDY 0, RDY 1, & PSOK indicators are lit on the DMU.	1st: 2nd: Both:	1.6 2.3 1.9	0.8-3.0 1.3-3.5 0.8-3.5	5 5 10
5. Deploy whip antennas.	1st: 2nd:	2.2 (not available)	1.7-2.4	6
6. Deploy antenna group & raise mast.	1st: 2nd: Both:	5.5 7.0 6.2	4.0-7.0 5.8-9.2 4.0-9.2	7 6 13
7. Initialize the MCS: make appropriate entries to the Local, Network, & RDLS parameters screens.	1st: 2nd: Both:	7.4 6.7 7.0	2.6-14.5 5.2-9.8 2.6-14.5	7 10 17
8. Set up voice link.	1st: 2nd: Both:	2.3 1.4 1.8	1.4-4.0 0.5-2.6 0.5-4.0	6 9 15
9. Set up data link & reporting link.	1st: 2nd: Both:	6.0 4.2 5.0	3.2-9.0 2.8-6.3 2.8-9.0	7 9 16
10. Perform BITE. [Note. This is a machine dependent function; hence times reflect system rather than operator performance.]	1st: 2nd:	(not available) 1.5	0.9-2.4	6
11. Set up a general search plan. [Note: Students entered one or two sub-bands.]	1st: 2nd:	(not available) 1.7	0.9-2.5	9
12. Develop exclusion frequency list. [Note: Students entered from one to four frequencies.]	1st: 2nd:	(not available) 1.0	0.2-1.6	9
13. Set up the DS plan. [Note: Students entered from one to three frequencies.]	1st: 2nd: Both:	1.4 0.9 0.9	n/a 0.5-1.3 0.5-1.4	1 10 11

TABLE 2.7(17) (U) PERFORMANCE TIMES FOR SELECTED OPERATIONAL TASKS
(Continued)

Task	Training class	Mean time (min)	Range	N
14. Edit DS plan & activate DS.	1st:	1.8	n/a	1
	2nd:	(not available)		
15. Clear DS activity.	1st:	0.4	n/a	1
	2nd:	(not available)		
16. Access DS activity data.	1st:	0.4	n/a	1
17. Zeroize head disk assemblies.	1st:	0.5	n/a	1
	2nd:	(not available)		
18. Zeroize COMSEC equipment.	1st:	0.6	0.4-0.6	6
	2nd:	0.4	0.2-0.7	9
	Both:	0.5	0.2-0.7	15
19. Lower mast & stow antenna group.	1st:	6.7	5.1-9.0	7
	2nd:	6.5	4.4-9.8	6
	Both:	6.6	4.4-9.8	13
20. Power off MCS. [Times do not reflect required three minutes cool-off period.]	1st:	1.2	0.5-2.5	6
	2nd:	1.4	1.1-1.8	7
	Both:	1.3	0.5-1.8	13
21. Stow whip antennas.	1st:	1.5	0.8-2.0	7
	2nd:	(not available)		

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Examination of Table 2.7(17) indicates that the major time consumers among the measured tasks were: (a) preparing & connecting the power source (the trailer support unit, which carried the 30 kW generator); (b) deploying the antenna group and raising the mast; (c) initializing the MCS; (d) setting up the data and reporting link; and lowering the mast and stowing the antenna group. The first three of these constitute much of the activity that is preparatory to mission operations; together they sum to 18 minutes. It should also be noted that it was not uncommon for the slowest students to take four or five times as long as the fastest to accomplish a given task.

2.7.4.4.4.2 (U) Crew performance times for field setups. A record of setup times was kept by the test directorate data collectors. The setup period is defined as beginning when the track vehicle, trailer, and crew of three operators arrive at the designated geographical site and ending when the equipment for that particular site becomes operational (at the end of set BITE). During post-training field practice a running log of one crew's setup activities was kept. It is informative, because it illustrates the kind of

activities required and a few of the problems encountered that may add time to the setup period.

22 May 1989

0810: Crew departs training compound in M1015A track; trailer support unit with generator in tow.
0910: Arrive at field site. [Setup starts.] Site planning initiated.
0915: Site planning completed. Begin parking carrier & trailer.
0924: Trailer positioned; being unhooked from track; trailer legs being deployed.
0928: Begin to position track.
0938: Track positioned. Feeding out power cable.
0942: Power cable won't reach. Will have to reposition track.
0943: Carrier moved within reach of cable.
0944: Cable is backwards. Will have to switch around.
0946: Cable switched; soldier attempting to connect cable connector to shelter; doesn't have sufficient strength; requires assistance.
0947: One end of cable connection complete.
0948: Other end of cable connected by soldier who then starts to connect ground wires; another soldier deploys whip antennas atop shelter.
0951: Soldier atop carrier preparing for antenna deployment; ground wires still being worked on.
0955: Generator is started, but stalls because of operational error.
0956: Antenna group being deployed.
0957: Generator started.
0958: Sun has made metal exterior of shelter hot; the soldier atop places rag against it for protection when leaning on the metal.
0959: Start to raise mast; dipoles extended. Two crew members inside shelter preparing for initialization; KY-57 being loaded, etc.
1000: Initializing. Attempting radio check with another site--successful.
1003: All crew inside shelter.
1005: Loading KG-84 & 45.
1007: BITE test.
1014: Ready to go. [Completion of setup. Total time 1 hour, 4 minutes.]
1015: Working on search plans; reading mission instructions.
1020: Waiting for other nets to "come up." Sierra Delta still missing.
1039: All sets up. Running system BITE.
1042: Start mission.

The setup crew performance times presented below are for field test sites 1, 2, and 5 only, because special mission requirements prevented the crews at the remaining sites (1A, 3, 4 & 4a) from performing all of the normal site layout procedures. Also, the setup times for day 1 of the field test are not included in summary because the setup requirements were to some extent atypical. (The times were 38 & 42 minutes, respectively, for sites 1 & 2; no time was available from site 5 on day 1.)

2.7.4.4.4.2.1 (U) Normal (non-MOPP) setups. Table 2.7(18) shows the mean number of minutes required for normal setups throughout the field test. The data are averaged by crew and for the first and second halves of the field test period to show the changes in crew performance over time. Crew setup

times for the second half of the test were, on the average, slightly less than for the first half, although two of the five crews took slightly more time during the second half. It should be stressed that these setup times must be considered ideal: (a) The crews were accustomed to the site locations, which eliminated the need for significant site planning activities; (b) ground rods were already in place, which eliminated a potentially very time-consuming activity; (c) the crews were used to working with one another (soldiers were not rotated among crews); and (d) the weather was usually ideal.

TABLE 2.7(18) (U) SYSTEM SETUP TIMES (MINUTES) UNDER NORMAL CONDITIONS

Time segment	Crew set-designator (n = no. of setups) A (n)	B (n)	C (n)	D (n)	E (n)	Weighted mean[a] (N)
1st half	24 (2)	21 (7)	33 (9)	39 (14)	30 (10)	30 (42)
2nd half	27 (7)	25 (9)	30 (10)	27 (8)	26 (9)	27 (43)
Overall	26 (9)	23 (16)	31 (19)	34 (22)	28 (19)	29 (85)

[a]Computed from the crew means, each weighted by the number of setups the crew performed during the time segment.

UNCLASSIFIED

2.7.4.4.4.2.2 (U) MOPP-IV setups. The amount of comparable data for MOPP setups was limited, because most of the MOPP-IV setups were conducted within the training compound rather that at field sites. Eight MOPP setups were performed by the crews at sites 1, 2, and 5 during the test. One is excluded because of abnormal, unrelated problems that interfered with performance time. The average time for the remaining seven setups was 35 minutes, 4 minutes longer that the average for normal setups.

2.7.5 (U) Discussion.

2.7.5.1 (U) Personnel data. The sample of user personnel who participated in the Trailblazer IOTE appeared to be representative of the population user. All were of the appropriate MOS, and rank at the beginning of training ranged from PFC to SFC. (During the IOTE several of the soldiers were promoted, so the range of ranks at the end of the test period was from SP4 to SFC.) However, selection of the user sample did not involve consideration of variables potentially related to the representativeness of the sample, such as time in MOS, duty assignment, educational background, ASVAB scores (e.g., General Technical [GT] and Skill Technical [ST]), age, sex, etc. One student made the following relevant comment: "If they're going to use optimum conditions to test the equipment, they should use optimum soldiers for the testing; i.e., soldiers who have [worked], are [working], or will work with this system in their unit. Comments you hear from [them] will be a lot different [from] those [you hear from us], who have taken this system on a 25 day exercise. Why not bring [those] soldiers here for the testing instead of

troops who have never or will never see a tactical assignment in their military career?"

2.7.5.2 (U) Training support package. The comments of the operators and maintainers and ARI observations pointed to many specific deficiencies in the training and training materials, and the trainers themselves offered suggestions. Chief among the general concerns were the following: Both the operators and the maintainers expressed a need for (a) more hands-on and more "realistic" training, less classroom training, shorter courses; (b) instructors who are more knowledgeable, especially in the areas of intelligence and the 98G MOS; (c) more adequate explanation of concepts and interrelationships among concepts--the "whys and wherefores"; (d) less wasted training time--manifested primarily in the overemphasis on certain topics such as system operations for maintenance students and in waiting around for the availability of equipment or hands-on time with the system computers; (e) additional or more effective training in several areas, primarily in trouble-shooting procedures and practice, maintaining the antenna system, operating and maintaining the M1015A track vehicle, and operating the ground rod driver; communicating with the TCAC--receiving taskings and creating reports and transmitting them via the reporting link (f) more adequate equipment support--too much downtime that interferes with training schedules.

2.7.5.3 (U) Training materials. Among the main concerns associated with training materials were: (a) lack of documentation, especially for the M1015A, 30kW generator, trailer support unit, and ground rod driver; (b) errors in the manuals (especially for maintenance); (b) too much information devoted to system operations in the "dash 20" maintenance manual; (c) lack of information in the maintenance manual pertaining to the antenna system; (d) the very poor quality of illustrations; and (e) lack of durability of the operator's and maintenance manuals; (f) inadequate indexes.

2.7.5.4 (U) User performance.

2.7.5.4.1 (U) Critical tasks. Despite the task lists presented in Tables 2.7(13), (14), and (15), there is no adequate list of critical tasks and subtasks available. Such a list is critical to (a) a systematic approach to training and performance evaluation, (b) the development of efficient and effective training materials, including manuals, and (c) to the development of performance standards by which training progress and achievement can be gauged.

2.7.5.4.2 (U) Performance standards. Adequate task analyses and performance standards were not available for either Trailblazer operations or maintenance. Consequently, the requirement that representative users be able to perform 100% of the tasks to required standards 90% of the time is, in the strict sense of the word, impossible to apply. Related information was obtained from the users, however, by asking them, in effect, to estimate the probability that a soldier trained as they were would be able to perform all of the critical tasks 90% of the time. (The term "critical" was left undefined.) The operators guessed about two thirds; the maintainers, three fourths. The trainers, who would be expected to be somewhat more optimistic, said 87% and 95%, respectively.

2.7.5.4.2.1 (U) Operator's end-of-course written examination. Because of the lack of a criterion (cutoff point) below which the student's knowledge

would have been judged unsatisfactory, the examination did not apply an objective standard to student performance. While most of the students achieved what ordinarily would be considered satisfactory scores, the objective meaning of any particular score on the test is difficult to judge with confidence. Hence, the overall average 92.6 may or may not reflect reasonably adequate knowledge at that point in the operators' interaction with the Trailblazer system. One problem is that the test is too easy (73% of the items were answered correctly by 94% of the students) and is not, therefore, sufficiently able to distinguish adequately among students on a wide variety of topics; although it did indicate the possible need for more training emphasis in three areas. The validity of the test would need to be substantiated before such meaning could be established. As it is, it provides a rough estimate of the relative knowledge levels of the students and can be used as an indication of areas in which remedial training may be advisable and as an indication of areas in which the training should be improved.

2.7.5.4.2.2 (U) Operator's end-of-course hands-on performance evaluation.

2.7.5.4.2.2.1 (U) It was a forgone conclusion that all of the students would pass this "evaluation." The kind of information that such a hands-on test is capable of yielding about student performance was not captured by the trainer, and all students were, indeed, given "go's" on all of the many tasks they were requested to perform. The evaluation was very time consuming for the trainer and the students (four days were devoted to it for these classes), and unless it is put to more functional use in the future (e.g., incorporating it as hands-on training, not testing), consideration should be given to eliminating it from the training package.

2.7.5.4.2.2.2 (U) The amount of time required for the students to find material the operator's manual was excessive, especially when it is considered that the instructor typically provided assistance. According to the students, the manual played only a small role during their training, which may account in part for the difficulty. Whether the manual's index or tables of contents were partly to blame is not known, although terms that one would expect to find in the index were not there (see Table 2.7(12)). Although the sample of observations was small, the most looked-up material had to do with updating directed and general search plans, topics that perhaps should receive more emphasis in future training classes.

2.7.5.4.2.3 (U) Certification of students as Trailblazer operators. Student were in actuality certified on the basis of their participation in the operators course and not on the quality of that participation. Fortunately, most of the students appeared to grasp the essentials of the requirements well enough so that by helping one another they were able to function well enough to participate in the field exercise phases of the IOTE.

2.7.5.4.2.4 (U) Evaluations of maintenance students. Examination of the maintenance instructors' training record sheets shows the complete waste of effort that went into keeping these records. The sheets reveal no differences at all among the four maintenance students, even though literally hundreds of data points were recorded. To make the use of these sheets even a moderately useful exercise, the training would have to feature realistic student evaluations capable of showing performance distinctions.

2.7.6 (U) Conclusion.

2.7.6.1 (U) Performance criterion.

2.7.6.1.1 (U) There were no viable objective standards applied to operator or maintainer performance either during training or during system deployment, system operation, or system maintenance. Thus, it was not possible to determine strictly whether user personnel met the performance criterion specified in the TDP. Nevertheless, because the operators and maintainers did perform the tasks necessary for the conduct of the IOTE, it is possible to justify, with the qualifications below, the conclusion that representative user personnel were able, after training, to employ, operate, and maintain the AN/TSQ-138 system in an operational environment.

2.7.6.1.2 (U) Qualifications pertaining to the performance criterion. (a) Although the training for operations and maintenance were both concluded with written examinations and hands-on practical exercises, no objective standards were applied to determine the quality of the student's performance: There was no cutoff point (passing score) on the written exam and no applied objective measurement of time, errors, or any other aspect of student performance during the hands-on examination. Essentially, all students "passed" both portions of the examination regardless of the quality of their individual performances. Thus, while the students were able to take the system to the field and operate and maintain it, any statement regarding the quality or adequacy of operator and maintainer performance must be based solely on subjective considerations. (b) The operators were not required to perform actual search activities during the field test. As one operator put it, "The test does not require the operators to use their [operational] skills and knowledge of the system to any significant extent." Hence, the effectiveness of post-training tactical mission performance (operators performing in a realistic tactical scenario) cannot be assessed.

2.7.6.2 (U) Training materials criterion.

2.7.6.2.1 (U) Training materials were neither complete nor accurate. The operator trainers and the operators cited the lack of available manuals for the M1015A carrier, the trailer support unit (including the 30 kW generator), and the ground rod driver. The Operator's Manual contained frequent minor errors, omissions, and other problems and inadequacies (e.g., very poor illustrations, some confusion about power-up/down procedures, and no information about the new tape recorder). The maintenance trainers and the maintainers also cited the shortage of manuals and noted an inordinate number of errors in their maintenance diagrams and flow charts.

2.0 (U) TEST RESULTS

. . .

2.8 (U) ISSUE 8. SAFETY AND HEALTH

(U) Do safety or health aspects exist that may impact on the AN/TSQ-138 system employment or maintenance in an operational environment?

2.8.1 (U) Methodology.

(U) Emphasis was placed on identifying soldier-equipment interface factors related to safe operation and maintenance of the system. All hazardous or potentially hazardous situations or conditions noted by the user during the test that had or could have adverse effects on the safe operation and maintenance of the system in an operational environment were recorded by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). The methods used were: (a) direct observations and measurements; (b) detailed, structured and informal interviews of operators and maintainers prior to and during the field test; and (c) administration of comprehensive questionnaires and rating scales to operators, maintainers, and instructors. An ARI research psychologist was on site throughout the operator and maintenance training period and portions of the IOTE field exercises. Safety, health, and electrical engineering specialists were not available to conduct official evaluations in these areas during the IOTE.

2.8.2 (U) Criteria.

2.8.2.1 (U) Criterion. The assigned crew must be capable of emplacing, displacing, operating, and maintaining the system as configured, with no adverse safety impact (identified safety hazards having a risk assessment code described as a deficiency in accordance with AR 385-16 and AR 40-10).

2.8.2.2 (U) Criterion. The system must meet electrical equipment design specifications of MIL-STD-454 and safety standards in accordance with MIL-STD-1474.

2.8.3 (U) Specific methodology.

2.8.3.2 (U) Trailblazer MANPRINT Evaluation Questionnaire.

2.8.3.2.1 (U) To assess user attitudes and obtain user comments, suggestions, and criticisms of the system, ARI administered a comprehensive questionnaire consisting of rating scales and open ended questions covering in detail a wide range of topics, including safety and health, that pertain to the Trailblazer system. The instrument, a copy of which is provided at Appendix B, was administered to all operators and maintainers at the end of the IOTE field test, when their accumulated Trailblazer experience was at its greatest.

2.8.3.2.2 (U) The respondents rated the safety and health topics on the following 5-point scale:

Very good	Good	Borderline	Poor	Very Poor
1	2	3	4	5

Only those topics rated from "borderline to very poor" (i.e., greater than 2.5) or for which at least 50% of the operators or maintainers provided written comments are summarized in the results presented below. (The complete set of comments is found at Appendix B.) The scale data and pertinent respondent comments are summarized.

2.8.3.3 (U) Another ARI questionnaire, the Trailblazer Questionnaire for Instructor Personnel (similar to the MANPRINT Evaluation Questionnaire), was completed by three Trailblazer operations instructors and three Trailblazer maintenance instructors. The data and the instructors' comments pertaining to safety and health are summarized. Again only items with ratings above 2.5 or for which at least 50% (2 out of 3) of the respondents provided written comments are included. Also, non-constructive and non-substantive comments have been omitted. (The complete set of comments is included in Appendix B.)

2.8.3.4 (U) The compiled safety and health related results of comprehensive interviews of both operators and maintainers are also presented, as are ARI observations.

2.8.3.5. (U) Risk assessment codes were assigned to each identified hazard or potential hazard in accordance with the severity and probability categories specified in AR 40-10.

2.8.4 (U) Results.

(U) This section provides data to answer the specific questions posed in the IOTE Test Design Plan (TDP). The questions pertain to two general areas: operations and maintenance. They, along with the associated TDP data requirement designations (DRs) are listed in Table 2.8(1).

TABLE 2.8(1) (U) QUESTIONS POSED BY THE TDP

TDP 2.8.3.1	Are there any safety aspects that may impact on the AN/TSQ-138 employment or maintenance in an operational environment?
Operations:	
TDP 2.8.3.1.1	Is the AN/TSQ-138 safe to operate by military personnel? (DRs 2.8.3.1.1.1-18)
Maintenance:	
TDP 2.8.3.1.2	Is the system safe to maintain by military personnel? (DRs 2.8.3.1.2.1-7)

2.8.4.1 (U) Safety and health aspects of Trailblazer operations and maintenance.

2.8.4.1.1 (U) Operator ratings and comments.

2.8.4.1.1.1 (U) Trailblazer MANPRINT Evaluation Questionnaire. Table 2.8(2) summarizes the safety and health findings obtained with the Trailblazer MANPRINT Evaluation Questionnaire. In the table, the three-digit item number from the questionnaire is followed by the mean scale rating (Rtg) of the operators who responded to the item. Items are listed in order of their ratings. (Some of the topics in the questionnaire were covered as open ended questions; for them, no numerical ratings are shown. They follow the items with ratings.) Nearly all of the 15 operators rated each of the items in the questionnaire; on the average, the ratings are based upon 14 respondents. The number of operators entering written comments for an item was typically fewer than the number who rated the item on the scale; hence the percentage of respondents providing comments is shown after the topic listing. This percentage does not reflect the number of respondents making any particular comment, but only the number of respondents providing any comment whatsoever. Non-substantive and approbative comments normally are not shown (they will be found at Appendix B). A synopsis of substantive comments follows each topic listing.

TABLE 2.8(2) (U) OPERATOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS

No. Rtg Topic [% responding with comments]: Gist of comments

066 4.8 CPE (collective protection equipment) [87%]: Unsafe with respect to weight, supporting brackets, integrity of seal, stability, & deployment procedures. "Extremely dangerous." Support brackets too weak, broke during training. Instructors "almost lost control (& almost seriously injured themselves) trying to erect [it]. They never could form a seal." "Extremely cumbersome." "Too heavy."

043 4.0 FOOTSTEP for entering & leaving shelter [100%]: [See also item 130.] May be seriously damaged from sharp turns & jackknifing with TSU. Once damaged, becomes more hazardous than normal. Even undamaged, unsafe because of small size & height. "Small & easy to miss when in a hurry or under poor visibility conditions [such as] night & MOPP IV." "Extraordinarily slippery when wet or muddy."

037 3.9 NOISE LEVELS [93%]: [See also item 119.] (a) "Painful." "Headaches abound." Both generators too loud. Ear protection a must. (b) "How about a better muffler?" "There are a lot of quiet, more reliable, smaller generators on market which can fill same requirements." (c) Will affect crew rest.

064 3.9 M1015A TRACK VEHICLE (Suitability for Trailblazer?) [93%]: "Center of balance seems too high." "Top heavy."

119 3.7 NOISE LEVELS [80%]: [See also item 037.] (a) Inside shelter: Generators (especially 60 kW) & track are too loud. Noise hazard exists for operator deploying antennas during on-board generator operations. "Carrier is extremely loud--hearing protection a definite must." A danger both to hearing & security of personnel & system. (b) Outside shelter: High with on-board generator in use. Without headset on, is loud even without on-board generator running. "High pitched tones inside."

122 3.7 CLIMBING SURFACES [87%]: [See also items 042, 128, 129, & 137.] (a) Serious shortage of handholds & steps on sides, top, & back of shelter. (b) Inadequate footing in places where operator must normally perform tasks; e.g., for antenna shroud tasks, dipole & whip antenna deployment, checking hydraulic fluid dipstick & air tank. Slippery when wet.

130 3.7 SHELTER FOOTSTEP [93%]: Footstep gets in way of TSU tongue when turning, causing significant damage to step: connecting bolts break, structure bends, causing step to slope dangerously downward. [Very slippery when muddy.]

134 3.7 GROUND ROD DRIVER [73%]: [See also item 033.] (a) "Dangerous, unstable on hard ground." "Worked only if someone stood on it." (b) Unsafe handle. (c) "Too many moving parts."

033 3.6 GROUND ROD DRIVER [87%]: [See also item 134.] (a) "Not powerful enough: A team member often has to stand on top & ride it down to put enough pressure on driver--dangerous!"

TABLE 2.8(2) (U) OPERATOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
137	3.6	WALKING & CLIMBING ON VEHICLE OR SHELTER SURFACES [80%]: [See also items 042, 122, 128, & 129.] (a) "Very little foot space, easy to lose balance." "Slick surfaces." "Numerous trip hazards," especially at night. "Very dangerous in MOPP gear; passable under normal circumstances." "Extreme care necessary installing & removing whip antennas in MOPP or darkness." "Nothing to hang on to." (b) "Sharp surfaces to catch clothing on."
042	3.5	HANDHOLDS for climbing onto shelter [80%]: [See also items 122, 128, 129, & 137.] "What handholds?" Need handholds for climbing along sides of shelter, reaching whip antennas, releasing tie-downs. Need handhold forward, curbside: Currently, only thing to reach for is 524 mount, tie-down cable, or exhaust.
049	3.4	BRUSH GUARD RELEASE [80%]: "Handle busted off in my hand . . . I went flying off top rail of vehicle." Broke twice; handle fell off once. "Very weak design." Not strong enough for force required to operate it. Handle too small for good grip.
128	3.4	HANDHOLDS [60%]: [See also items 042, 122, 129, & 137.] "What handholds?" Need more on top, around edges, sides.
068	3.3	AIR CONDITIONER [80%]: (a) Uneven distribution of cooled air. Operator at position 2 [against back wall] was typically significantly cooler than at position 1, making it difficult for both operators to be comfortable at same time. "I was wearing my long underwear inside shelter in Arizona in middle of summer. Computer compartment that needs to be cooled should be insulated from operators." "Feet get cold while head & chest are still warm."
121	3.3	HEAD CLEARANCE [73%]: [See also item 069.] Emergency light is most significant safety hazard. [Personnel frequently hit their heads on light.]
129	3.3	FOOTHOLDS [53%]: [See also items 042, 122, 128, & 137.] "More needed." Available footholds are too high. "Not deep enough." "Small."
036	3.2	60 KW GENERATOR & ITS CONTROLS [80%]: (a) Much too noisy; "System will not survive in wartime situation long enough to be effective. Aerial & long range surveillance will find it with no problems." Decreases chances of survival by increasing chance that track will be inoperable. (b) Too much chance of vehicle falling into gear & out of control. Need a transfer-case decoupler to avoid accidentally putting track in gear during operations. (c) "Important: Emergency stop button needs to be usable even when main power switch in track is off."
067	3.2	MOPP IV PERFORMANCE <u>outside</u> shelter [93%]: (a) "Very hazardous on top of shelter." "Extremely dangerous! I personally was 'left hanging' because my overjacket & boot was caught on various screws & hoses (climbing

TABLE 2.8(2) (U) OPERATOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments

down from top to engine platform)." Hazard of falling especially when working with whip antennas at night. Lack of handholds, built-in ladders. (b) Limited visibility & peripheral vision. "At night, one could barely see." (c) "Day temperature almost unbearable"; "dangerous." (d) Need to exercise extra caution to overcome limited visibility & to gain footing in MOPP boots.

089 3.2 BREAKER ACCESS PANEL DOOR [87%]: (a) Should open away from shelter door. "I bumped into it & gouged my arm." "Just right height to catch your knee when open."

069 3.1 EMERGENCY LIGHT [73%]: [See also item 121.] Very poor location: "I hit my head on it 43 times. Move it!" "Personnel are constantly bumping heads." Needs to be repositioned towards center of shelter to facilitate usefulness & to protect against head injury.

123 3.1 HOT OBJECTS [80%]: (a) Vehicle engine exhaust pipe poses a significant hazard to operators who must climb up (without appropriate handholds) & work in vicinity. "I've burned myself on it accidentally." (b) "Only an idiot grabs a muffler." (c) While engine exhaust pipe is partially shielded, personnel heater exhaust is completely exposed.

074 3.0 WRITING SURFACES [87%]: Corners of shelves are sharp; operators commonly hit their elbows.

131 3.0 SHARP OR POINTED OBJECTS [40%]: (a) Wire mesh at ends of power cable. (b) Chains that hold dust caps on power cable [sharp edges; cut operator's hand; see also item 040]. (c) Ground cable on TSU [clamps often missing: stiff, sharp wire ends.]

040 2.9 POWER CABLE PROTECTIVE CAPS [53%]: Connecting chain was sharp--caused cut to operator's hand [see also item 131].

044 2.9 EXHAUST PIPE, ENGINE [73%]: "Very hot following movement; easy to bump into when climbing up [onto shelter]." A burn hazard, because tempting to use hot pipe as handhold. Noise, heat, & breathing problem when running on-board generator & deploying antenna; exhaust in face. When driving slow, exhaust sometimes blows in passenger window.

031 2.8 TSU [80%]: Easy to pinch fingers in fold-up doors on generator pose a hazard to fingers.

065 2.8 STEERING THE M1015A TRACK VEHICLE [40%]: (a) "Challenging on downward slopes because of weight." Pivot steering is a problem because you momentarily lose control while switching controls. (b) Insufficient training.

139 2.8 OVERALL SAFETY OF TRAILBLAZER SYSTEM for operating or maintaining? [27%]: (a) Safe only when caution is emphasized in training. (b) Height of

TABLE 2.8(2) (U) OPERATOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		track puts operators at some peril. (c) No "unreasonable" problems if system used properly.
120	2.7	CARBON MONOXIDE LEVELS [60%]: (a) "Sometimes I could smell exhaust fumes inside shelter with door shut." "Must be careful of where TSU is parked; however, wind changes can bring exhaust into shelter." (b) "Constant [exposure] during deployment, setup, & when outside during operation. "Should perhaps be a consideration during setup; however, not mentioned during training." (c) Exhaust sometimes blows into track's crew cab.
127	2.7	RF ENERGY [40%]: (a) "Data link pulse is unsafe for survivability." (b) Training did not adequately warn operators about staying away from RT-524 whip antenna when operational.
045	2.6	EXHAUST PIPE, HEATER [67%]: (a) "Could be major safety problem if heater is used." (b) Tends to be used as handhold for climbing--needs to be more sturdy.
060	2.6	ANTENNA LEVEL [80%]: "I had to lean out, stand on my toes, hold part of shelter with one hand & signal with other." "Requires precarious position."
046	2.5	WHIP ANTENNAS [60%]: (a) Guard & HF antennas should remain mounted permanently to speed setup & reduce fall hazard created by present location & necessity to install during each setup; is especially important for MOPP & night operations. All whip antennas are dangerous to deploy, because individual must climb over & around things not designed for walking on. "Extreme care necessary [when] installing & removing whip antennas in MOPP or darkness." (b) RT-524 antenna base should be designed to pivot 45 degrees rearward during travel to minimize danger if tie-down clip pops off accidentally; otherwise poses an electric shock hazard [from power lines]. (c) All whip antennas should have safety balls on tips; otherwise serious injury possible. (d) Provision of tie-downs would reduce installation time & increase operator safety.
055	2.5	SADDLE CLAMP SCREWS [60%]: Screw is too close to shroud: "A couple of times I've lost skin."
035	2.3	30 KW GENERATOR & ITS CONTROLS [67%]: "Much too noisy."
025	n/a	WHAT WAS THE MOST SERIOUS SHORTCOMING, IF ANY, ASSOCIATED WITH YOUR TRAILBLAZER TRAINING? WHY? [93%]: "Soldiers who had no previous experience with tracked vehicles were given only one day to learn & become proficient with system carriers. This is a grave safety deficiency."
112	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF DEPLOYING THE TRAILBLAZER SYSTEM? [8%] (a) Position of dipoles crank & locking pin, & lack of

TABLE 2.8(2) (U) OPERATOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		anything solid on which to stand. (b) "Maneuvering track along narrow, steep or rutted roads (top heavy, sways a lot)."
113	n/a	ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [73%] (a) "Fire extinguisher falls off." (b) Rear step gets damaged when making sharp turns with TSU connected.
114	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF OPERATING THE TRAILBLAZER SYSTEM? [87%] "Being cold & hot at same time--cold feet, warm upper body & head."

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2.8.4.1.1.2 (U) Operator interview findings. Table 2.8(3) organizes safety and health findings obtained from operator interviews conducted by ARI. Interview findings that were essentially identical to those obtained with the Trailblazer MANPRINT Evaluation Questionnaire are not repeated, although gratuitous comments obtained with the questionnaire that did not belong to one of the questionnaire topic areas are included here. Significant editorial additions, comments, or changes are enclosed in brackets.

TABLE 2.8(3) (U) OPERATOR INTERVIEW FINDINGS: SAFETY & HEALTH HAZARDS

No. Topic: Gist of comments

01. TRAILER SUPPORT UNIT: (a) Engine compartment covers: Easy to pinch fingers when folding covers up. (b) Battery PMCS: Generator batteries are located in small compartment with very little head room for conducting PMCS. Operator's eyes must come within two to four inches of open battery acid cells when inner most cells are being checked for fluid levels. [One operator was observed checking levels with bare finger because of difficulty of seeing into battery cells--potentially dangerous.] (c) Mud thrown up by track could pose health hazard in some locations. One operator related experiences in another country in which mud thrown up by track from contaminated waters would "smell for days & attract flies."

02. M1015A TRACK VEHICLE: (a) "Most unsafe feature of system is possibility that track will start moving accidentally during operations, especially when on-board 60 kW generator is in use. There is no way to lock transfer case in neutral." (b) Pivot steering: In order to pivot steer, one must release both lateral brake handles & then pull on pivot handles. During changeover from laterals to pivot handles (which is of short duration--in the order of one second), there is no braking or steering control of vehicle. Problem is exacerbated when driver does not possess above average strength--easy use of pivot handles takes great strength. Only breaking effect during pivot steering on an upgrade is gas pedal, which, of course, wouldn't work on a down grade. Thus, having to negotiate a sharp turn on a steep down grade may require driver to alternate rapidly & frequently between pivot & lateral controls. (c) Lock-open latches on side of vehicle for securing tailgate in open position did not hold at all [on at least one set]. Very dangerous in a wind--[heavy mass of door swinging around could cause injury to personnel].

03. CARBON MONOXIDE & OTHER FUMES: Whether shelter air conditioning intake would ever be expected to shunt carbon monoxide or other exhaust components from generators or vehicle engine into shelter under adverse conditions of wind speed & direction was not determined. One instructor said he remembered times when he has been able to feel warm air from generator while standing in doorway of shelter.

04. GROUND ROD DRIVER: (a) "Very dangerous. I would rather drive by hand if time were not critical." (b) When stop (brake) on winch handle is released, there is enough rotational force to hurt or injure if handle is not adequately restrained by operator.

05. GROUND ADEQUACY: Operator or maintainer is provided no way to determine whether effective electrical ground has been established for TSU & M1015A. Currently, is taken on faith. Furthermore, appears likely that strict adherence to proper PMCS & procedures for ensuring effective ground will not always occur. During IOTE, ground cables were observed to be haphazardly connected to ground rods on numerous occasions; cables were not buried, as recommended, even though they transversed customary walking paths; little attention was paid to ground connections at "other ends" (at TSU & M1015A) where rust, debris, or loose connections might increase resistances. In rocky, dry soils, necessary requirements for a good ground may not be met,

TABLE 2.8(3) (U) OPERATOR INTERVIEW FINDINGS: SAFETY & HEALTH HAZARDS (Continued)

No.	Topic: Gist of comments

especially in tactical situation, since they are time consuming. Operators, maintainers, & instructors alike exhibited little other than "street" knowledge about relation between grounding procedures & system safety. Some even felt that grounds were really unnecessary.

06. EXHAUST PIPE, HEATER: TM 9-2350-247-10 (p. 1-3, change 2) states that there are "guards to prevent injury to personnel or damage to cargo compartment cover." No guards were apparent; exhaust pipe is in position that makes it a very tempting handhold for climbing to deck behind cab from roadside. If pipe is hot, using it as handhold could cause injury to personnel. Other handholds are needed to reduce temptation to use this exhaust pipe.

07. BRUSH GUARD RELEASE HANDLE: Integrity of handle is unreliable. It poses definite danger of serious bodily injury during normal deployment. Danger would be increased by deployment that necessitates parking with roadside of M1015A vehicle close to embankment or in location where ground surface poses hazards such as rocks or other objects that may injure falling soldier. Handle is deficient in two respects: One, plastic or plastic-like material of which it is constructed is prone to breaking under normal stress exerted when used for intended purpose; two, retaining screw can be loose to point of falling out without a change in appearance of handle. (On two of the five Trailblazer sets [shelters 27 & 39] used for IOTE, the screws were observed to be loose: One had backed out 1/4 inch; another 1/8 inch. Thread length is about 11/16ths inch, but amount of thread actually used when screw is fully turned in is about 1/4 inch; therefore, the screw that was observed to be 1/4 inch out was nearly ready to fall off & posed a definite danger.

08. BRUSH GUARD RELEASE MECHANISM: "Because mechanism frequently does not work well, operator or maintainer must sometimes walk down edge of track & manually release latch. This may allow antenna group to pop out suddenly (especially when crank handle has been used purposely to force mast against latch so that antenna will be released when latch is manually depressed). Sudden release of antenna could cause person to fall off track [approximately a nine foot drop from belt level].

09. ANTENNA GROUP CRANK MECHANISM: Includes a protective shear pin, which breaks if undue force is applied to mechanism. When pin breaks, operator looses control of antenna group. One shear pin broke during IOTE training phase. [An instructor recounted following incident, which did not take place during IOTE]: "Pin broke, & antenna swung out of shroud & out over a cliff, carrying with it a female soldier who had been standing on carrier next to shroud. [Because antenna could not be cranked in], vehicle had to be moved to rescue soldier & to regain control of antenna group."

10. ANTENNA TRANSPORT RETAINING FASTENER: The fact that handle is often very difficult to release means that operator uses a lot of body leverage. Two safety hazards exist if handle releases unexpectedly: (a) Operator may fall off platform & (b) operator may come intact with a hot exhaust pipe.

TABLE 2.8(3) (U) OPERATOR INTERVIEW FINDINGS: SAFETY & HEALTH HAZARDS (Continued)

No.	Topic: Gist of comments
11.	DIPOLES DEPLOYMENT: Typically, operator stands on back part of cab framework, which is neither designed for nor well-suited to that use. Besides causing damage to frame--"I have seen it break, & one of frames used in test is bent badly--[down] maybe two feet." It is a safety hazard. Operator could easily slip & fall. There should be a specific, secure place to stand.
12.	SHELTER DOOR LOCK-OPEN BRACE: Operator caught ring on brace while unlocking it. Before he could release hand, had already stepped down, which left him hanging until he could recover. No injury occurred in this incident.
13.	FOOTSTEP AT SHELTER: Dangerous when it gets muddy: "It's super, super slippery, & when you get in MOPP IV, you can't even find it."
14.	ELECTRICAL SHOCK HAZARDS: "Design of air conditioner cover is such that when it rains, cover acts as funnel for water to be channelled into shelter by way of A/C vents. On many occasions after rain, inside of shelters were 1.5 to 3 inches deep in water! This makes power-up VERY unsafe!"
15.	POWER DISTRIBUTION BOX: "Left door of panel, when open, blocks access to shelter. If maintainer (or operator) is injured from electrical shock & is lying against open door, it may be extremely difficult for person on outside to gain safe or easy access to provide assistance. Similarly, a person on inside may not be able to get out to shut down power (door may be 'hot')."
16.	EMERGENCY LIGHT: "If you change only one thing on system, change that stupid emergency light. I've hit my head on that thing at least 500 times since I've been out here."
17.	DATA LINK RECEIVER: Transmits constant pulse signal. Will be targeted by enemy. Should be way of remoting away from shelter to increase survivability of system & operator. Even 50 or a 100 meters better than nothing. "Doctrinal application for system is that we're supposed to be so far back that remoting is not a factor. But I would like a remote capability."
18.	INTERCOM CONTROL: An operator at position 2 complained that volume was too loud & could not be attenuated sufficiently.
19.	OPERATOR HEADSETS: Their adequacy as hearing protection from interior equipment noise was not determined.
20.	HEADSET CONNECTOR BOX: Connector for H-161D/U headsets is located in footwell; very easy to hit one's knee. "Very painful--caused bruise."
21.	COAT HOOKS: They protrude at eye level for some operators.

2.8.4.1.2 (U) Instructor ratings and comments--operations. Table 2.8(4) summarizes the operations-related safety and health findings obtained with the Trailblazer Questionnaire for Instructor Personnel. The questionnaire was completed by three of the operations instructors. The presentation format follows that of the Table 2.8(2).

TABLE 2.8(4) (U) OPERATIONS-INSTRUCTOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS

No.	Rtg	Topic [% responding with comments]: Gist of comments
030	n/a	VEHICLE LEVELING GAUGES [67%]: Front gauge is a safety hazard because you have to climb up vehicle to read it.
031	n/a	TSU [67%]: "Serious injury or death" could result from "electrical shock" or from accident while maneuvering TSU.
033	n/a	GROUND ROD DRIVER [100%]: Winch handle can be a safety hazard--operator must stay clear.
036	n/a	60 KW GENERATOR & ITS CONTROLS [67%]: (a) Vehicle has a "tendency to jump out of gear," which could cause death. (b) Hearing protection required.
110	n/a	NOISE HAZARDS [67%]: (a) "Ensure that soldiers wear hearing protection at all times when working around a started vehicle or 30/60 kW generator." (b) "Inside noise."
112	n/a	HEAD CLEARANCE [100%]: (a) A problem inside, "especially at entrance of shelter." Lack of head room inside. "Neckaches." (b) Emergency light is hazardous; personnel bump their heads on it.
113	n/a	CLIMBING SURFACES [100%]: (a) "Have to be very careful." (b) "Inadequate handholds."
119	n/a	FOOTHOLDS [67%]: "Inadequate."
121	n/a	HANDHOLDS [67%]: "Inadequate."

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2.8.4.1.3 (U) Maintainer ratings and comments.

2.8.4.1.3.1 (U) Trailblazer MANPRINT Evaluation Questionnaire. Table 2.8(5) summarizes the safety- and health-related comments of four maintainers obtained with the Trailblazer MANPRINT Evaluation Questionnaire. The format of the tables is the same as that of Table 2.8(2).

TABLE 2.8(5) (U) MAINTAINER RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS

No. Rtg Topic [% responding with comments]: Gist of comments

049 4.0 BRUSH GUARD RELEASE [100%]: Easily broken off. Needs to be metal rather than plastic. [See also Table 2.8(3), item 07.]

066 4.0 CPE (collective protection equipment) [100%]: Too heavy. Mounts of aluminum alloy will break easily. "Seal does not work at all." "Junk; haven't seen one work yet."

067 4.0 MOPP IV PERFORMANCE outside shelter [50%]: "Safety atop shelter would be my biggest concern. MOPP gear is in no way streamlined for monkeying around 10 feet off ground."

036 3.8 60 KW GENERATOR & ITS CONTROLS [100%]: "Unreliable & dangerous to operate."

037 3.5 NOISE LEVELS [100%]: (a) "Entirely too loud." "Very noisy." "Too noisy too work on outside." "Not enough adequate hearing protection provided." (b) "Enemy will have NO PROBLEM locating us!"

044 3.5 EXHAUST PIPE, ENGINE [75%]: (a) Burn hazard to operators climbing onto shelter & when standing on deck behind cab to raise antenna. (b) "Too close to passenger in cab."

065 3.5 STEERING THE M1015A TRACK VEHICLE [25%]: "[Maintaining] even tension on laterals is a problem."

119 3.5 NOISE LEVELS [75%]: "Very noisy." "Unsafe outside shelter, especially when using 60 kW." "Need to ensure use of adequate hearing protection at all times."

123 3.2 HOT OBJECTS [100%]: "Exhaust & heat pipes are too close to climbing areas & can be grabbed by accident."

128 3.2 HANDHOLDS [75%]: [See also items 042, 122, 129, & 137.] (a) "Too small." (b) Need more along side to work on antenna." (c) Need "something at curbside forward corner away from [exhaust] stack."

042 3.0 HANDHOLDS for climbing onto shelter [75%]: (a) "When in MOPP gear, hand/footholds need to be much larger!" (b) "Shelter handhold on curb side toward front of shelter would help because tie down (which is all there is to grab) is right by exhaust pipe." (c) "Need some."

125 3.0 MOVING MACHINERY [50%]: (a) Moderate safety hazard involved in hooking up TSU. (b) It is quite unsafe to "manually [depress] brush guard release & [pull] antenna over your head" [see also Table 2.8(3), item 8].

137 3.0 WALKING & CLIMBING ON VEHICLE OR SHELTER SURFACES [75%]: [See also items 042, 122, 128, & 129.] (a) "[Footing] is very unstable [because of] cables & winch bar [used] for shelter stability." "Dangerous; not enough room to walk safely." "No place to step on antenna side."

TABLE 2.8(5) (U) MAINTAINER RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
088	2.8	POWER DISTRIBUTION BOX [50%]: "Blocks door when working on it" [see also Table 2.8(3), item 15].
121	2.8	HEAD CLEARANCE [50%]: Emergency light constitutes a moderate hazard.
122	2.8	CLIMBING SURFACES [50%]: [See also items 042, 128, 129, & 137.] Inadequate. "Foot/handholds too small."
126	2.8	ELECTRICAL SHOCK HAZARDS [50%]: "Design of A/C cover is such that when it rains, cover acts as a funnel for water to be channelled into shelter by way of A/C vents. On many occasions, after a rain, inside of shelters were 1.5 to 3 inches deep in water! This makes power-up VERY unsafe!" "If pouch is necessary, it should have a drain hole in bottom."
134	2.8	GROUND ROD DRIVER [75%]: "It's safe because it never works."
139	2.8	OVERALL SAFETY OF TRAILBLAZER SYSTEM for operating or maintaining [0%].
129	2.7	FOOTHOLDS [25%]: [See also items 042, 122, 128, & 137.] "Too small."

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2.8.4.1.3.2 (U) Maintainer interview findings. No additional safety or health hazard findings surfaced during interviews with the maintenance personnel.

2.8.4.1.4 (U) Instructor ratings and comments--maintenance. Table 2.8(6) summarizes the safety- and health-related findings obtained with the Trailblazer Questionnaire for Instructor Personnel. Three maintenance instructors completed the questionnaire. The presentation format follows that of Table 2.8(2).

TABLE 2.8(6) (U) MAINTENANCE INSTRUCTOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS

No.	Rtg	TOPIC [% responding]: Gist of comments

065 5.0 EMERGENCY LIGHT [100%]: [See also item 112.] Location is a safety hazard. "It should be on wall or forward bulkhead."

063 3.5 HOW GOOD IS THE CPE (COLLECTIVE PROTECTION EQUIPMENT) SUPPLIED WITH THE M1015A SHELTER? WHAT PROBLEMS, IF ANY, HAVE YOU EXPERIENCED OR DO YOU ANTICIPATE? [33%] "Have been working with CPE for past two years, & have not seen it work properly yet. Too heavy, too bulky, will not seal properly. I don't trust support brackets because we had one break while one of our people was standing on platform."

033 n/a GROUND ROD DRIVER [100%]: "Dangerous." "Store in a room with CPE [see item 63].

037 n/a NOISE LEVELS [100%]: "Critical safety hazard," which tends to be ignored by many. "Too high." "Very high," especially 60 kW.

041 n/a HANDHOLDS for climbing onto shelter [100%]: [See also item 121.] (a) "Not enough." (b) "A few more would be nice, but this is not a problem."

042 n/a EXHAUST PIPE, ENGINE [100%]: (a) With their protective screens, there is "little danger of getting burns." Need to be "clearly marked for safety." (b) Its location competes with that for operating or maintaining mast systems.

043 n/a EXHAUST PIPE, HEATER [67%]: (a) No problem if clearly marked for safety.

044 n/a WHIP ANTENNAS [100%]: (a) "Eventually somebody is going to get hurt from falling. (b) A handhold should be installed to prevent voice link mast mount from being used instead.

049 n/a CRANK HANDLE FOR DIPOLE ELEMENTS [100%]: Operator has to stand on cab [frame] in order to reach it.

105 n/a WHAT ARE MOST DIFFICULT ASPECTS OF EMPLOYING TRAILBLAZER SYSTEM? [100%]: "Noise."

106 n/a ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [100%]: (a) "brakes on most of TSU's are in questionable condition. Some are unsafe." (b) "pivot steering on many of tracks is unreliable." (d) "Noise."

107 n/a WHAT ARE MOST DIFFICULT ASPECTS OF OPERATING TRAILBLAZER SYSTEM? [100%]: "Noise" [same as item 106].

108 n/a WHAT ARE MOST DIFFICULT ASPECTS OF MAINTAINING TRAILBLAZER SYSTEM? [100%]: "Noise" [same as item 106].

TABLE 2.8(6) (U) MAINTENANCE INSTRUCTOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	TOPIC [% responding]: Gist of comments
110	n/a	NOISE HAZARDS [100%]: (a) "This is definitely a problem that is not getting enough attention from supervisory personnel. A safety supplement should be developed & incorporated into tech manual that requires hearing protection within a certain limit (20, 25, or 50 feet) of an operating generator, more for 60 kW generator." (b) "TSU." (c) "Yes."
111	n/a	CARBON MONOXIDE [100%]: (a) Proper site setup procedures should be followed. (b) "TSU." (c) "Yes."
112	n/a	HEAD CLEARANCE [100%]: [See also item 065.] "A definite problem with emergency light." Hazardous when "climbing in."
113	n/a	CLIMBING SURFACES [100%]: (a) "This is a real safety hazard when it is wet." "Poor."
114	n/a	HOT OBJECTS [100%]: Must use precautions; hazardous after track engine has been in use.
115	n/a	CREW SEAT BELTS [100%]: (a) "Shoulder harnesses would be an added safety device." (b) "Needed."
116	n/a	MOVING MACHINERY [100%]: (a) "Track has too many problems." (b) Safety should be emphasized.
117	n/a	ELECTRICAL SHOCK HAZARDS [100%]: Ensure that power cable is connected before generator is started.
118	n/a	RF ENERGY [67%]: Stress danger in touching voice link antenna during operations.
119	n/a	FOOTHOLDS [67%]: "Not enough."
120	n/a	SHARP OR POINTED OBJECTS [100%]: (a) "There is a definite knee hazard on lower position of DMU compartment & [at the] weapons rack." (b) "Too many."
121	n/a	HANDHOLDS [67%]: [See also item 041.] "Not enough."
122	n/a	SHOCK HAZARDS [67%]: "Power distribution panel."
126	n/a	SEAT BELTS [100%]: "Need shoulder harness installed."
127	n/a	GROUND ROD DRIVER [100%]: "Dangerous." "Should be eliminated from system."
128	n/a	WALKING & CLIMBING SURFACES [100%]: (a) "Care should be observed when system is wet." (b) "Poor."

TABLE 2.8(6) (U) MAINTENANCE INSTRUCTOR RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	TOPIC [% responding]: Gist of comments
129	n/a	WARNINGS & CAUTIONS IN MANUALS [100%]: Overall adequate. More explanation would help operator understand consequences of failing to followed prescribed procedures.
131	n/a	WHAT PROBLEMS REGARDING SAFETY OR HEALTH HAZARDS SHOULD BE ADDRESSED IN OPERATOR'S (OR MAINTENANCE) MANUAL BUT ARE NOT? [100%]: "[Need] more RF energy warnings."

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2.8.4.1.5 (U) TDP data requirements--operations. This section applies the safety and health data presented in previous paragraphs to the specific operational data requirements (DRs 2.8.3.1.1.1-18) set forth in the TDP (TDP para 2.8.3.1.1). The hazards listed in this section were noted by the operators, maintainers, and instructors. Risk assessment codes for listed hazards were estimated by ARI in accordance with AR 40-10; they are shown in braces. The code numbers range from 1 to 5, 1 being the most consequential (highest risk) and 5 being the least consequential (lowest risk). [All photographs provided by test directorate.]

2.8.4.1.5.1 (U) Safety inspection (DR 2.8.3.1.1.1). No official safety inspection was conducted. The comments of operator, maintainers, and instructors related to system safety were summarized in Tables 2.8(2)-(6).

2.8.4.1.5.2 (U) Sharp or pointed objects (DR 2.8.3.1.1.2) (personnel hazard):

1. {5} WIRE MESH (POWER CABLE).
2. {5} CAP RETAINING CHAINS (POWER CABLE).
3. {5} END OF GROUND CABLE WIRE.
4. {5} PROTRUDING INSTALLATION GUIDE (KEY) IN DMU COMPARTMENT.
5. {5} WEAPONS HOLDER.
6. {5} COAT HOOKS.
7. {5} HEADSET CONNECTOR IN OPERATOR'S FOOTWELL.
8. {5} CORNERS OF WRITING SHELVES.

2.8.4.1.5.3 (U) Head clearance (DR 2.8.3.1.1.3) (personnel hazard):

1. {2} WITHIN SHELTER (NORMAL OPERATIONS & MAINTENANCE). Adequate with exception of downward protruding emergency light just inside entrance of shelter.
2. {3} WITHIN SHELTER (TRAINING). Inadequate for trainers or other personnel 5'8" or taller who must stand for extended periods. The taller the person, the worse the hazard.
3. {4} BATTERY PMCS (TSU GENERATOR): Insufficient clearance; eyes near battery acid.

2.8.4.1.5.4 (U) Hot objects (DR 2.8.3.1.1.4) (personnel hazard):

1. {3} ENGINE EXHAUST PIPE.
2. {3} HEATER EXHAUST PIPE.

2.8.4.1.5.5 (U) Moving machinery (DR 2.8.3.1.1.5):

1. {2} M1015A TRACK VEHICLE (personnel & system hazard). Accidental movement of.
2. {2} M1015A TRACK VEHICLE (personnel & system hazard). Unsuccessful steering.
3. {3} GROUND ROD DRIVER (personnel hazard). Runaway handle; other moving parts; soldiers standing on it may fall.
4. {4} M1015A track vehicle (personnel hazard). Attaching TSU.
5. {4} ANTENNA GROUP (personnel hazard). Unexpected release from shroud.
6. {4} MAST (personnel hazard). Falling.
7. {4} TAILGATE (personnel hazard). Unexpected swing in wind.

2.8.4.1.5.6 (U) Electrical shock sources (DR 2.8.3.1.1.6) (personnel hazard):

1. {2} GROUNDING. Insufficient.
2. {2} SHELTER FLOOR. Water on, from air conditioning cover after rain.
3. {3} POWER CABLE. Improper installation or damage.

2.8.4.1.5.7 (U) Emergency lighting, provision (DR 2.8.3.1.1.7). Adequate emergency lighting was provided.

2.8.4.1.5.8 (U) Normal lighting (DR 2.8.3.1.1.8). Normal lighting was adequate.

2.8.4.1.5.9 (U) Glare (DR 2.8.3.1.1.9). Glare was inconsequential.

2.8.4.1.5.10 (U) Grounding rods, provision (DR 2.8.3.1.1.10). Provided.

2.8.4.1.5.11 (U) Grounding rods, problems (DR 2.8.3.1.1.11) (personnel hazard). The driver was considered dangerous (see earlier comments & para 2.8.4.1.5.5, item 1).

2.8.4.1.5.12 (U) Seat belts, provision (DR 2.8.3.1.1.12). Seat belts were provided. [Comment: SEAT BELTS WERE FREQUENTLY UNUSED (personnel hazard) {4}. Also, they tended to slip beneath cab seat. Whether they could get caught in moving parts below seat was undetermined.]

2.8.4.1.5.13 (U) Walking and climbing surfaces (DR 2.8.3.1.1.13) (personnel hazard).

1. {3} FOOTSTEP, SHELTER. Downward slope from damage; slipperiness; small size; MOPP IV visibility.
2. {3} FOOTING ALONG & ATOP SHELTER. No dedicated footing provided; slipperiness; MOPP IV visibility, awkwardness.

2.8.4.1.5.14 (U) HANDHOLDS (DR 2.8.3.1.1.14) (personnel hazard) {3}. Insufficient; inadequate.

2.8.4.1.5.15 (U) FOOTHOLDS (DR 2.8.3.1.1.15) (personnel hazard) {4}. Insufficient; inadequate; too small; too high.

2.8.4.1.5.16 (U) Operator's manual: safety coverage (DR 2.8.3.1.1.16). Adequate.

2.8.4.1.5.17 (U) Injury occurrences (DR 2.8.3.1.1.17). [Provided by test directorate.] All injuries reported to ARI by soldiers were of a very minor nature (cuts, scrapes, bruises, bumps).

2.8.4.1.5.18 (U) Operator and test directorate comments (DR 2.8.3.1.1.18). Operators rated overall safety "borderline." Their comments were summarized in Tables 2.8(2) and (3). (Maintainers also rated overall safety "borderline." Their comments are provided in Table 2.8(5). Instructors were not asked to provide a scale rating of safety; their comments are provided in Tables 2.8(4) and (6).) [Test directorate comments provided by the test directorate.]

2.8.4.1.6 (U) Operational hazards not addressed in TDP DRs. The following hazards were noted also by operators, maintainers, and their instructors. In addition, certain hazards may exist that are not addressed here or in previous paragraphs. Risk assessment codes (see para 2.8.4.1.5) for the following hazards are shown in braces:

1. {3} BRUSH GUARD RELEASE HANDLE (personnel hazard). Breakage; falling soldier.
2. {3} COLLECTIVE PROTECTION EQUIPMENT (personnel hazard). Used, as is, during peacetime.
3. {3} EMERGENCY STOP BUTTON (personnel & system hazard). Non-operational when main power switch in cab is off.
4. {3} OPERATOR STANCE FOR DIPOLES DEPLOYMENT (personnel & system hazard). Soldier may fall; M1015A cab frame can be bent.
5. {3} RF ENERGY (personnel hazard). Burn.
6. {4} ANTENNA TRANSPORT RETAINING FASTENER (personnel hazard). Unexpected release due to binding could cause soldier to fall.
7. {4} EGRESS/INGRESS BLOCKAGE. Power distribution door can block shelter door during electrical or other emergency.
8. {4} EXHAUST POISONING (personnel hazard).
9. {4} FIRE EXTINGUISHER (personnel & system hazard). Loss of during transit; non-functioning.
10. {4} NOISE LEVELS (personnel hazard). Hearing loss.
11. {4} SHELTER TEMPERATURE (personnel hazard). Illness, discomfort.
12. {4} WHIP ANTENNAS (personnel hazard). Eye or other injury from lack of protective tip caps.
13. {5} BREAKER ACCESS PANEL DOOR (personnel hazard). Operators bump against.
14. {5} CONTAMINATED MUD ON TSU COMPONENTS (personnel hazard). Illness.
15. {5} FINGER INJURY (personnel hazard). Folding TSU generator cover doors; minimal saddle clamp screw access; shelter door brace.

2.8.4.1.7 (U) Summary of risk assessment code distribution. Risk assessment codes ranging from 2 to 5 on a 1 to 5 scale (1 = highest risk; 5 = lowest) were assigned to 43 hazards, with the following distribution shown in Table 2.8(7).

TABLE 2.8(7) (U) RISK ASSESSMENT CODE (RAC) SUMMARY

RAC	No. of hazards
1	0
2	5
3	13
4	15
5	10
Total:	43
Mean RAC:	3.7

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2.8.4.1.8 (U) TDP data requirements--maintenance. This section responds to the specific maintenance data requirements (DRs 2.8.3.1.2.1-7) set forth in the TDP (TDP para 2.8.3.2.1). [All photographs provided by test directorate.]

2.8.4.1.7.1 (U) Maintenance manuals: safety coverage (DR 2.8.3.1.2.1). ARI examined the organizational maintenance manual (TM 32-5811-902-20&P). [Comments on other manuals provided by test directorate.] Warnings were provided in four general areas: (a) high voltages; (b) shelter ventilation; (c) ventilation when using chemicals; and (d) heavy lifts.

2.8.4.1.7.2 (U) Safety problems not addressed in manuals (DR 2.8.3.1.2.2). The following general areas related to maintenance were not mentioned in the organizational maintenance manual: noise levels, hot objects, slippery surfaces (when wet), and RF energy hazards. [Comments on other manuals provided by test directorate.]

2.8.4.1.7.3 (U) Number of maintenance injuries and explanations (DR 2.8.3.1.2.3). [Provided by test directorate.]

2.8.4.1.7.4 (U) Maintenance actions/tasks being performed during injuries (DR 2.8.3.1.2.4). [Provided by test directorate.]

2.8.4.1.7.5 (U) Maintenance personnel comments about causes of injuries DR 2.8.3.1.2.5). [Provided by test directorate.]

2.8.4.1.7.6 (U) Compliance with prescribed procedures by injured persons (DR 2.8.3.1.2.6). [Provided by test directorate.]

2.8.4.1.7.7 (U) Injuries resulting from omission in system manual (DR 2.8.3.1.2.7). [Provided by test directorate.]

2.8.5 (U) Discussion.

2.8.5.1 (U) Most significant equipment-related hazards. Probably the most significant hazards, taking into account both potential severity and likeli-

hood of occurrence over the life cycle of the system, are described in the following paragraphs.

2.8.4.1.1 (U) The possibility that the M1015A track vehicle will move unintentionally. Several of the operators expressed much concern about this.

2.8.4.1.2 (U) The difficulty of maneuvering the track vehicle over difficult terrain, especially for relatively inexperienced operators. Part of the problem here may be associated with the fact that the operators had had little or no previous experience driving the vehicle.

2.8.4.1.3 (U) The possibility of electrical shock or electrocution resulting from an inadequate ground. Of importance here is the lack of an available method for operators or maintainers to test the integrity of the ground once the ground rods had been driven and the cables connected. Furthermore, there was a general lack of knowledge on the part of operators, maintainers, and instructors regarding the importance of establishing a good ground. At least one operator stated that grounding was probably not needed--to which, of course, there is a wry truth: It's not needed until it's needed. There was a certain lackadaisical attitude on the part of some, the implication of which is that the failure of crews to establish adequate grounding may not be uncommon.

2.8.4.1.4 (U) The possibility of electrical shock or electrocution resulting from wet shelter floors. The actual extent of the danger was not established; the risk assessment code was based, as for the other hazards, on the potential severity as indicated by the expressed concern of the user and the expected frequency of occurrence.

2.8.4.1.5 (U) The possibility that personnel may injure their heads on the emergency light just inside the shelter doorway. Personnel frequently bumped their heads--sometimes hard. This was one of the primary and most frequent complaints of the user.

2.8.5.2 (U) Other major user concerns.

2.8.5.2.1 (U) A topic of considerable concern to operators was their belief that the system would be, for two reasons, very vulnerable to easy detection and destruction on the battlefield: (a) the considerable noise signature produced by both the track and 30 kW generator engines; and (b) the pulse signal reported to be emitted by the data link receivers.

2.8.5.2.2 (U) All personnel were especially concerned about the dangers of attempting to use the collective protection equipment--both from the standpoint of setup hazards and the lack of equipment effectiveness once set up.

2.8.5.2.3 (U) Great emphasis was also placed upon the general difficulty of having to climb around and atop the shelter without adequate handholds, footholds, and footing.

2.8.6 (U) Conclusion.

2.8.6.1 (U) The assigned crews were capable of deploying, operating, and maintaining the AN/TSQ-138 during the IOTE with no noted injuries or health impacts of consequence.

2.8.6.2 (U) There are safety related factors that may impact on the future employment and maintenance of AN/TSQ-138 in an operational environment. Forty-three hazards considered of significance were noted by operators, maintainers, and their instructors. On the basis of potential severity of consequence and likelihood of occurrence over the life of the system, the hazards were assigned estimated risk assessment codes in accordance with AR 40-10. None received the highest risk code (1). The average was 3.7 on the 5-point scale. An official safety evaluation was not conducted.

2.8.6.3 (U) There were no health factors noted during the IOTE that would be expected to have a significant future impact on the employment and maintenance of AN/TSQ-138 in an operational environment. An official health evaluation was not conducted.

2.0 (U) TEST RESULTS

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2.9 (U) ISSUE 9. HUMAN FACTORS

(U) Does the AN/TSQ-138 comply with human factors engineering (HFE) principles?

2.9.1 (U) Methodology.

(U) The human factors engineering evaluation was conducted by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). An ARI research psychologist, who was on site throughout the operator and maintenance training and portions of the IOTE field exercises, obtained human factors data relevant to the human factors issue data requirements (DR) listed in the Trailblazer IOTE Test Design Plan (TDP). User-machine interface factors that have potential or observed adverse effects on the efficient and effective operation and maintenance of the system in an operational environment were identified through (a) direct observation and measurement; (b) detailed, structured and informal interviews of operators and maintainers prior to and during the field test; (c) assessments of operator performance factors (time and errors) during the test period; and (d) administration of comprehensive questionnaires and rating scales to operators, maintainers, and instructors.

2.9.2 (U) Criteria.

2.9.2.1 (U) Criterion. The AN/TSQ-138 must allow access to equipment components to facilitate operations and maintenance tasks.

2.9.2.2 (U) Criterion. The AN/TSQ-138 must comply with the human factors requirements of MIL-STD-1474B and 1472, and the noise limits of MIL-STD-1474.

2.9.3 (U) Specific methodology.

2.9.3.1 (U) Trailblazer MANPRINT Evaluation Questionnaire.

2.9.3.1.1 (U) To assess user attitudes and obtain user comments, suggestions, and criticisms of the system, ARI administered a comprehensive questionnaire consisting of rating scales and open ended questions covering in detail a wide range of topics pertaining to the Trailblazer system. The instrument, a copy of which is provided at Appendix B, was administered to all operators and maintainers at the end of the IOTE field test, when their accumulated Trailblazer experience was at its greatest. In particular, the questionnaire contained sections pertaining to human factors outside and inside the Trailblazer operations shelter. Factors outside the shelter included site layout and system setup procedures, operational conditions, and equipment operations and maintenance. Factors inside included system mission operations, operator- and maintainer-equipment interface, environmental and operational conditions, software, and operator error.

2.9.3.1.2 (U) The respondents rated many of the topics on the following 5-point scale:

Very good	Good	Borderline	Poor	Very Poor
1	2	3	4	5

Only those factors rated from "borderline to very poor" (i.e., greater than 2.5) or for which at least 50% of the operators or maintainers provided written comments are summarized in the results presented below. (The complete set of comments is found at Appendix B.) The scale data and pertinent remarks are summarized.

2.9.3.2 (U) Another ARI questionnaire (Trailblazer Questionnaire for Instructor Personnel), similar to the MANPRINT Evaluation Questionnaire, was completed by three Trailblazer operations instructors and three Trailblazer maintenance instructors. The data and the instructors' comments pertaining to human factors are summarized. Again only items with ratings above 2.5 or for which at least 50% (2 out of 3) of the respondents provided written comments are included. Also, non-constructive and non-substantive comments have been omitted. (The complete set of comments is included in Appendix B.)

2.9.3.3 (U) The compiled results of comprehensive interviews of both operators and maintainers are also presented, as are ARI observations.

2.9.3.4 (U) An evaluation of the detailed requirements of human engineering design criteria was beyond the scope of this test. However, applicable general human engineering design requirements were addressed. They included considerations of the following factors: (a) the design and layout of storage and work spaces; (b) lighting; (c) ventilation; (d) provisions for ingress, egress, and passage; (e) physical accommodations for personnel; (f) emergency protective equipment; (g) rapidity, ease, and economy of operation and maintenance; (h) tools; (i) clothing requirements (MOPP-IV performance); (j) design simplicity and ruggedness; (k) thermal, mechanical, electrical, RF energy and noise hazards; and (l) safety. The last two factors are covered in detail in the previous section of this report (para 2.8).

2.9.4 (U) Results.

(U) This section provides data to answer the specific questions posed in the TDP. The questions are organized into two general areas--operations and maintenance--and listed in Table 2.9(1). The TDP DRs associated with each question are shown in parentheses. The presentation of results is also organized into operations and maintenance sections.

TABLE 2.9(1) (U) QUESTIONS POSED BY THE TDP

	Human factors aspects of operations[a]
TDP 2.9.3.1	What are the human factors aspects of the AN/TSQ-138?
TDP 2.9.3.1.1	Is the AN/TSQ-138 and associated equipment easy to operate? (DRs 2.9.3.1.1.1-8)
TDP 2.9.3.1.2	Did operator discomfort result from the system operating temperature? (DRs 2.9.3.1.2.1-4)
TDP 2.9.3.1.3	Does the system minimize operator-induced failures? (DRs 2.9.3.1.3.1-3)
	Human factors aspects of maintenance
TDP 2.9.3.2	What are the human factors aspects of maintaining the AN/TSQ-138?
TDP 2.9.3.2.1	Can maintenance personnel readily gain access to circuitry power cables, connectors, and other essential system components to perform repair and replacement? (DRs 2.9.3.2.2.1-2)
TDP 2.9.3.2.2	Are circuitry and replaceable components properly labeled or identified? (DRs 2.9.3.2.2.1-4)
TDP 2.9.3.2.3	Are system components easily transported? (DRs 2.9.3.2.3.1-3)

[a]The term "personal" is used in the TDP; the term "personnel" is substituted in this report.

UNCLASSIFIED

2.9.4.1 (U) Human factors aspects of Trailblazer operations.

2.9.4.1.1 (U) Operator ratings and comments.

2.9.4.1.1.1 (U) Trailblazer MANPRINT Evaluation Questionnaire. Tables 2.9(2) and (3) summarize the results obtained with the Trailblazer MANPRINT Evaluation Questionnaire for outside and inside of the operations shelter, respectively. In the tables, the three-digit item number from the questionnaire is followed by the mean scale rating (Rtg) of the operators who responded to the item. Items are listed in order of their ratings. (Some of the topics in the questionnaire were covered as open ended questions; for them, no numerical ratings are shown. They follow the items with ratings.) Nearly all of the 15 operators rated each of the items in the questionnaire; on the average, the ratings are based upon 14 respondents. The overall mean across all rated items was 2.7, which falls in the upper part of "borderline" region and in the lowest part of the upper half of the scale. Approximately 39% of the rated items were judged "good" or "very good." About 9% fell in the "poor" to "very poor" range, while the remaining 52% were rated "borderline." The number of operators entering written comments for an item was typically fewer than the number who rated the item on the scale; hence the percentage of respondents providing comments is shown after the topic listing. This percentage does not reflect the number of respondents making any particular comment, but only the number of respondents providing any comment whatsoever. Non-substantive and approbative comments normally are not shown

(they will be found at Appendix B). A synopsis of substantive the comments follows the topic listing.

TABLE 2.9(2) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS OUTSIDE THE SHELTER

No. Rtg Topic [% responding with comments]: Gist of comments

066 4.8 CPE (collective protection equipment) [87%]: Unsatisfactory with respect to weight, supporting brackets (which broke), integrity of seal (could not be achieved), stability, ease of reach, dust cover zipper, utility & maintenance of dust cover, & deployment procedures (time consuming & extremely cumbersome). "Extremely dangerous." Instructors "almost lost control & almost seriously injured themselves trying to erect [it]. "It is a totally worthless piece of equipment!"

043 4.0 FOOTSTEP for entering and leaving shelter [100%]: [See also item 130.] (a) Seriously damaged from sharp turns & jackknifing with TSU. [On two of the five Trailblazer sets, steps were seriously damaged.] (b) Once damaged, becomes more hazardous than normal; even undamaged, it is unsafe because of small size & height. "Easy to miss when in a hurry or under poor visibility [such as] night & MOPP 4." "Extraordinarily slippery when wet or muddy." (c) Need additional step below this one. Replace with ladder.

037 3.9 NOISE LEVELS [93%]: (a) "60 kW ridiculous for a tactical environment." "Hardly tactical." Impractical for anywhere near front line: "The bad guys will be able to hear it from a long way away." Both generators too loud. Ear protection a must. (b) With 60 kW, communications inside shelter restrained. (c) "How about a better muffler?" "There are a lot of quiet, more reliable, smaller generators on the market which can fill same requirements." (d) Will affect crew rest.

064 3.9 M1015A TRACK VEHICLE (Suitability for Trailblazer? [93%]: (a) Too slow; not built for weight of load; "five mph up steep hills! Should be called 'Snailblazer.'" "Can't keep up with armored & mechanized units it is supposed to support." "Maximum speed on flat road 20 mph; downhill, 36 mph." (c) "Strain on engine & transmission to be run at maximum rpm." "Under-powered, underprotected, over tall, over aged." (c) "Top heavy." Limited maneuverability (especially with TSU), limited deployability. "Setup with TSU in a small area too difficult given need for level ground."

033 3.6 GROUND ROD DRIVER [87%]: [See also item 134.] (a) Very unreliable; works well only in soft ground. Not powerful enough: "A team member often has to stand on top & ride it down to put enough pressure on driver--dangerous!" Sledgehammer more practical. "[In two years] I never saw a ground-rod driver that worked properly." (b) Cables not sufficiently protected from damage. Connector ("cannon plug") on control box (on deck behind cab) should be protected; it gets stepped on & broken: [observed to be broken off on two of the five Trailblazer sets].

039 3.6 POWER CABLE INSTALLATION [80%]: (a) "Weak link in whole system." Very to extremely difficult to install--especially for smaller persons, especially at shelter end, & especially in MOPP IV. Hard to match up; have to "wiggle" it into place. Requires two people. Much time could be saved during setup with easier cable installation. Why can't TSU end remain connected?

TABLE 2.9(2) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		(b) "Locking ring on shelter end uses reverse threads!" Threads need to be larger. (c) Why not a step on side of vehicle instead of ladder?
042	3.5	HANDHOLDS for climbing onto shelter [80%]: (a) "What handholds?" Need handholds for climbing along sides of shelter, reaching whip antennas, releasing tie-downs. Lack of proper handholds is a "safety hazard." Curbside forward, only thing to reach for is 524 mount, tie-down cable, or exhaust. Could use built-in ladders. Inadequate for short persons.
053	3.5	DATA LINK ANTENNA ELEMENTS [80%]: (a) Ground plane elements break off easily during vehicle movement: "We lost some almost every time we deployed." Some sort of protective cover (canvas; extension of shroud, etc.) would help. (b) Lack of adequate clearance [measured at approximately 1/8th inch on one set] for elements when antenna group is stowed or deployed. (c) Because data link star must be removed prior to vehicle movement, could get lost; should be permanent.
038	3.4	POWER CABLE SPOOL [87%]: (a) "Tedious," "cumbersome," "very heavy." Physically demanding for smaller persons. Slow installation, especially in MOPP gear. (b) Spool too small to hold cable easily. Speed of spool needs to be governed ("hold tension on spool") so that one person can operate; requires two persons. Cable connector that fits inside spool falls out, gets caught; need strap or something to hold it in place. (c) Needs to be protected from being covered with mud from track during movement.
048	3.4	ANTENNA SHROUD LATCH [73%]: "Inexcusably configured to be difficult to use." "We could never get ours to work properly." "Ours broke twice." Often stuck; locks shroud open or closed. "If a quick redeployment or escape is needed in a tactical situation, you're screwed if you can't stow your antenna."
049	3.4	BRUSH GUARD RELEASE [80%]: (a) Safety hazard: "Handle busted off in my hand . . . I went flying off top rail of vehicle." Broke twice. "Very weak design." (b) Handle too small for good grip. Difficult to lock open--inaccessible. "Easier to walk down to end of shroud & push brush guard down with my hand & pull antenna past it manually."
036	3.2	60 KW GENERATOR & ITS CONTROLS [80%]: (a) Too unreliable for sustained operations; engine speed of 2300-2500 rpm too fast, too hard on engine, for sustained operations. (b) Much too noisy; "This system will not survive in a wartime situation long enough to be effective." Decreases chances of survival by increasing chance that track will be inoperable. (c) Too much chance of vehicle falling into gear & out of control. Need a transfer-case decoupler to avoid accidentally putting track in gear during operations. "Important: Emergency stop button needs to be usable even when main power switch in track is off." (d) Why 60 kW? Too much outage, too much gas, too loud in & out of shelter.

TABLE 2.9(2) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS OUTSIDE THE SHELTER (Continued)

No. Rtg Topic [% responding with comments]: Gist of comments

041 3.2 TAILGATE [87%]: (a) Often very difficult to open & close. Latching mechanism awkward, inadequate; poor design; requires strength beyond abilities of some persons; a two-person job. (b) In sites with obstructions, may not open completely; in such instances, needs to be tied to a bush or something. Can't be opened with TSU hooked up. (c) "Why not just remove it?"

047 3.2 MAST TRANSPORT RETAINING FASTENER [67%]: Very difficult (impossible sometimes) to operate--especially for shorter soldiers who find it hard to get appropriate leverage. Sometimes requires great strength because of close tolerances (stiffness) & pressure (misalignment) applied to mechanism by weight of antenna group.

067 3.2 MOPP IV PERFORMANCE outside shelter [93%]: (a) "Very hazardous on top of shelter." "Extremely dangerous! I personally was 'left hanging' because my overjacket & boot was caught [while I was] climbing down from top to engine platform." Hazard of falling especially when working with whip antennas at night. Lack of handholds, built-in ladders. (b) "At night, one could barely see." "Difficult to give directions to front ground guide for connecting track to TSU." "Most difficult [task] is backing vehicle up for connection to TSU at night. "Lunette & hitch are very difficult to align." "Much more difficult to connect cable." (c) "Day temperature almost unbearable"; "dangerous." (d) "Greatly reduces speed, agility."

040 2.9 POWER CABLE PROTECTIVE CAPS [53%]: (a) Connecting chains too short for easy installation of caps; chain gets stiff. Chain was sharp--cut operator's hand. (b) Annoying, difficult, problematic, time consuming. Caps do not completely cover threads, which become encrusted with mud & dirt.

044 2.9 EXHAUST PIPE, ENGINE [73%]: (a) "Very awkward location . . . very hot following movement; easy to bump into when climbing up [onto shelter]." A hazard--tempting to use hot pipe as handhold. Noise, heat, & breathing problem when running on-board generator & deploying antenna; exhaust in face. When driving slow, exhaust sometimes blows in passenger window. (b) Blows black soot on 524 antenna mount area & antenna control box; "a real mess"; soils uniforms.

052 2.9 ANTENNA GROUP CLEARANCES when deploying or stowing [60%]: (a) Places undesirable constraints on site selection: "20 feet forward & 30 feet to driver's side could be difficult in a real tactical situation." (b) "Since our ground rod driver never worked, I would have removed it" because its location interferes with antenna group deployment. (c) Antenna sag causes difficulty cranking antenna group in & out--sometimes requires two persons.

031 2.8 TSU [87%]: (a) "Hard to maintain, hard to set up & tear down." "Requires a lot of troubleshooting & maintenance"--more knowledge needed. (b) Power cable difficult work with--heavy, cumbersome, gets covered with mud, has to be unearthed. "Mud guards should be installed to prevent excessive buildup of mud on TSU . . . [&] on power cable & [cable] connector on TSU."

TABLE 2.9(2) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments

(c) Locking pins for legs not sturdy, difficult to pull out. Problems with greased legs locking up. Legs slip in mount, then can't be raised. Legs themselves get stuck; requires more strength than some have. (d) Need more durable breaker bar for changing tires. Because TSU is on tires, it can't go places track can--no sense. (e) Lunette on track (ring that couples with trailer tongue) is very difficult to align with trailer tongue, especially on uneven ground, in poor light, etc.; this is most time-consuming part of setup & tear down. (f) "Too heavy & too loud for a tactical environment." (g) "Storage door latches too frail, bend easily, came open during transport." Fold-up doors on generator pose hazard to fingers. (h) Steps should be installed for climbing on front or rear of trailer.

065 2.8 STEERING THE M1015A TRACK VEHICLE [40%]: (a) "Challenging on downward slopes because of weight." Pivot steering is a problem because you momentarily lose control while switching controls. (b) Insufficient training.

054 2.7 QUICK-RELEASE PINS [67%]: (a) Dipole antenna release pin is too high because mast has been raised to clear ground rod driver. Better if pin were underneath mast rather than on top. (b) Antenna height limiter pin difficult to manipulate--lack of space for hand. [Retaining pin for height limiter on one set could not be inserted all the way. Tolerances were too small to allow for paint accumulation or bending of the two blades of Y-shaped pin receptor. If blades are not parallel, pin cannot be inserted through them.] (c) Retaining cables break off--pins get lost. (d) Get bent & become difficult to remove or insert.

056 2.7 ANTENNA HEIGHT LIMITER [27%]: (a) "Worthless." "Ours got broken." (b) [See Item 54 b-d.]

034 2.6 GROUNDING STRAPS/CABLES/CLAMPS [67%]: (a) Alligator clamps often missing; bolt clamps time consuming. (b) Ground rods bend in bolt cap while being driven, then can't be removed to add another section. (c) Cables often too short.

045 2.6 EXHAUST PIPE, HEATER [67%]: (a) "Could be a major safety problem if heater is used." (b) Tends to be used as a handhold for climbing--needs to be more sturdy.

060 2.6 ANTENNA LEVEL [80%]: (a) A two-person job to level mast. Angle should be able to be read at control box; control box (or another control box) could be situated at base of antenna. Antenna should stop automatically when it is level. Difficult for short persons to read: "If one isn't tall enough, forget it." (b) Safety hazard: "Requires precarious position"; "I had to lean out, stand on my toes, hold part of shelter with one hand & signal with other." (c) An electronic level light at control box would require only one person & could be easily seen at night. Hard to read at night & in MOPP 4. Need light or luminous markings for night operations.

TABLE 2.9(2) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
030	2.5	VEHICLE LEVELING GAUGES [53%]: (a) "Hard to read." Not visible to driver through plastic window of cab. Scratches on plexiglass made them difficult to read. Had to be cleaned frequently. (b) Bad location. Operators should not have to climb on vehicle to read. Should be lower for easy reference. (c) "The one in cab should be able to gauge entire system" to cut down on time.
046	2.5	WHIP ANTENNAS [60%]: (a) Guard & HF antennas should be mounted permanently to base of mast for speed of installation & reduction of fall hazard created by present location of whip antennas; is especially important for MOPP & night operations. All whip antennas dangerous to deploy, because individual must climb over & around things not designed for walking on. (b) RT-524 antenna base should be designed to pivot 45 degrees rearward during travel to minimize danger when tie-down clip pops off accidentally; otherwise poses an electric shock hazard [from power lines]. (c) All whip antennas should have safety balls on tips; otherwise serious injury possible. (d) Time-consuming setup; provision of tie-downs would reduce installation time & increase operator safety.
055	2.5	SADDLE CLAMP SCREWS [60%]: (a) Needs to be a latch rather than a screw; screw is sometimes hard to align & requires too many rotations. (b) Screw is too close to shroud: "A couple of times I've lost skin."
061	2.5	MAST HYDRAULICS [53%]: (a) Two slow. "Time is critical in actual mission." Gets slower with repeated use during short periods of time--looses pressure.
035	2.3	30 KW GENERATOR & ITS CONTROLS [67%]: (a) "Much too noisy." (b) Actuator/speed increaser non-operational. Students should be told about frequency adjuster during training. (c) Battery compartment hard to access; perhaps sliding tray would help. Difficult for short person to reach controls, even when standing on step.
057	2.2	MAST CONTROL BOX COVER [53%]: (a) Hinges not appropriate: they allow cover to come off easily & forces operator to realign cover before closing. (b) A clamp would suffice. (c) "Not waterproof." "Subject to being frozen shut by ice." Needs more sheltered location.

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TABLE 2.9(3) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS INSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
118	3.4	OPERATING WITH QUICKFIX [100%]: (a) Interoperations didn't work or didn't work well. (b) "Should only be used when there are not enough available operating Trailblazer systems to get fixes. Time/precedent requirements when in interop mode created 'inconsistent sets' rather than adding Quickfix LOBs to Trailblazer fixes." "Slows down Trailblazer response time too much with little appreciable effect on DF results." "DF request management should be improved so that ground operators can request more LOBs/LOPs from aircraft."
068	3.3	AIR CONDITIONER [80%]: (a) Position 2 significantly cooler than position 1; difficult for both operators to be comfortable at same time. "Usually 59 degrees." Computer compartment, which needs to be cooled, should be insulated from operators. (b) Unreliable: "Our A/C quit daily, requiring it to be reset; [maintenance] couldn't fix it--there is a problem either with unit design or tech manual covering repairs & troubleshooting procedures." (c) Zipper on outside cover typically inoperable. Zipper unnecessary; should just be able to roll cover aside.
089	3.2	BREAKER ACCESS PANEL DOOR [87%]: (a) "Nine locking screws to do job of one latch." "Time consuming & annoying." Easy access should be provided, because "breakers inside panel often switch off when main power (S-4) is thrown." A tool should not be required. (b) Screws become stripped too easily. (c) Door should flip up on spring hinge or slide up & down. (d) Safety hazard: "I bumped into it & gouged my arm"; "Just right height to catch your knee when open." Should open away from shelter door. "Is this cover even necessary? If switches weren't located in most prominent, most likely to be bumped area within shelter, then one could do without door."
116	3.2	MOPP IV PERFORMANCE inside shelter [100%]: (a) Generally miserable (too warm; mask gets heavy after awhile, etc.), but no extraordinary problems. (b) Most common hindrance: typing with gloves on; used pencils to manipulate keys. (c) Reduced visibility, especially downward; so required excessive head & neck movement to type, write, etc. (d) "If mask is worn with a hood, hearing is significantly impaired." (e) Quality of voice communications was "poor." "Very difficult to get headset's microphone into position to speak . . . without pulling it away from one ear." (f) Reduces operator alertness--tend to fall asleep. (g) Problem using foot switch with MOPP boots.
069	3.1	EMERGENCY LIGHT [73%]: (a) Safety hazard. Very poor location: "I hit my head on it 43 times. Move it!" "Personnel are constantly bumping heads." (b) Needs to be repositioned towards center of shelter to facilitate usefulness & to protect against head injury.
081	3.1	OPERATOR PANEL FOOT SWITCH [87%]: (a) Frequently sticks in ON position. (b) "Difficult to find; need an optional hand switch." (c) Easy to activate accidentally. (d) Common to have radio cut off in mid sentence.

TABLE 2.9(3) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments

"Sometimes problems with shorts." (e) "Should be a separate foot switch for radios & intercom/op comments." (f) Dirt & mud are its "worst enemy."

074 3.0 WRITING SURFACES [87%]: (a) Shelf at position 1 is prevented from extending fully by location of TA-312 field phone; significantly reduces usefulness of shelf. "Position 1 [shelf] is totally useless. We use clipboards." Shelf at position 2 interferes with arm of operator 1. [Surfaces are] "too small, but it's supposed to be a paper-free system (ha ha)." (b) Shelf for position 2 is very difficult to use if operator is left-handed. Writing angle is poor because chair doesn't swivel. (c) Corners of shelves are sharp; operators commonly hit their elbows.

085 3.0 SPEED OF THE COMPUTER from the user's point of view [80%]: (a) Response time too slow. Cursor "doesn't keep up with user, especially [at] line return." (b) "Not at all in keeping with technology available or, more importantly with speed capability requirement for a system with this . . . mission. Partial seconds can be crucial--it should not take 15+ seconds to call up directory."

073 2.9 OPERATOR CHAIRS [80%]: (a) Uncomfortable for extended use. Need to be height adjustable. Capacity to swivel "would be a big help" because writing surfaces are to side of operator. (b) Headrest & adjustments for inclination & lumbar area would be useful, as would improved forward & backward adjustability. With chair in rear position (common operating position), little room is left behind position 1 for operator from position 2 to pass by. " Not enough leg room." (c) In rearward position, position 2 chair hits NBC detector mount--problem is position of mount."

072 2.8 STORAGE SPACE within shelter [67%]: (a) Compartment with door needed (possibly near weapons rack) for storing manuals (which bounce about during transit & come apart) & other items such as forms, working implements, note pads, etc. Currently available space is awkward & inconvenient. Anything placed on shelves between position 2 & wall will fall out during transit. (b) There is an ammo can strapped to floor; it served no purpose.

086 2.8 RECEIVER CONTROL & DISPLAY UNIT [67%]: (a) Toggle switch tuning inadequate. "Toggle switches must go!" "This is 1989; I'm working with a system which performs its crucial function in a fraction of a second, & I'm tuning in frequency with toggle switches? It's a bad joke. Even worse is trying to knob tune." (b) Toggles "should continue to change [the frequency] if held down, instead of having to click for each increment." "Should have a keypad in addition to toggle switches & tuning knob. Also, tuning knob should have an adjustable tuning rate, probably the most frustrating shortcoming." (c) Spectrum display: "If it ever works (ours never did), is not needed." "Didn't help us in the least." "Utterly outmoded--can't keep up with receiver." "No real-time tuning." (d) "Does not provide for adequate manual search, nor does it provide ability to enter specific numbers in quickly." Inappropriate type of control unit--need something like improved Guardrail V."

TABLE 2.9(3) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		(e) "Need a NATO tone reject system to eliminate computer monitoring of friendly signals in DS mode."
075	2.6	WORK SPACE (for operations or maintenance procedures) [33%]: "Too cramped." "Quickly cluttered."
083	2.4	AUDIO RECORDER FOOT SWITCH [73%]: "Not used." "Not needed."
071	2.3	HEADROOM [53%]: Anyone over about 5'7" cannot stand up straight. Not a major problem because operators are seated most of time. [Can be a significant problem for an instructor or students during training, when several additional persons may try to crowd into shelter.]
078	2.2	KEYBOARD TYPING KEYS [53%]: "Carriage return [key] should be larger." A number pad would "improve efficiency." Escape key should have an "escape" function.
103	2.2	CLOCK [53%]: Not functional: "Usually didn't work." "Not accurate; must be wound & set; a small quartz clock would be extremely more dependable & accurate." People used their watches instead.
084	2.1	READABILITY OF PLASMA DISPLAY [67%]: (a) Good enough. (b) Better if "DF readout could be in larger, more readable numbers." "Hard to distinguish D's, 0's, & 8's." "Glare." (c) A little high for level of chair [above eye level]. (d) "Too hard to keep clean."
082	1.9	AUDIO RECORDER [80%]: (a) "Did not use." (b) "Far superior" [to previous recorder].
110	n/a	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? IF NOT, WHY? [93%] [Half answered yes, half no.] (a) Yes: "Especially for beginners." "For training purposes." System has "very extensive help files--a working aid would be very simple to write up & tape beside position." (b) No: Computer help file is sufficient. "In addition, when an incorrect command is entered, a complete list of commands is provided at bottom of screen." "After a while working with system, we know what commands to use."
111	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? (CONTROLS, INDICATORS, LIGHTS, DESIGN, TIME CONSTRAINTS, OR ANY OTHER HUMAN FACTORS, TRAINING FACTORS, SAFETY FACTORS, LACK OF APPROPRIATE SUPPORT.) [67%] (a) "Operators often forget to hit CR [carriage return] to exit initialization. INIT light should stay on until you exit. One set [remaining] in INIT [mode] screws up whole Trailblazer system." (b) "Circuit breaker activation sequence." "[Circuit breakers] should be [arranged] in order of power-up." (c) "Requirement to be in edit mode in order to enter data or make changes & [requirement] to exit edit mode before resuming operations." "Delay time when edit function key is used--

TABLE 2.9(3) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments

[delay] causes operators to press edit button again instead of waiting, which cancels command requested when button/key was pressed the first time." "Operators neglect to get out of edit & wonder why system [e.g., GS plan] isn't working." (d) Absence of "checklists (like on aircraft)." (e) "Urgency of mission may make operators careless." (f) "None."

112 n/a WHAT ARE THE MOST DIFFICULT ASPECTS OF DEPLOYING THE TRAILBLAZER SYSTEM? [87%] (a) Deploying & stowing power cable: "heavy, awkward"; "two man operation." (b) Trailer support unit hookup: "Reconnecting track to TSU (backing it up to trailer)." "Getting lunette lined up with trailer hitch." Required very experienced driver. (c) Setup/teardown: Time consuming to drive ground rods & erect & extend mast. "Shroud cover handle not releasing cover properly or easily." Accessibility of whip antenna mounts & tie downs. Position of dipoles crank & locking pin, & lack of anything solid on which to stand. Brush guard release & handle [in an interview, one operator said, "I cannot operate brush guard release handle--it takes too much strength"]. "Operating TSU legs after collecting road dust." (d) "Maneuvering track along narrow, steep or rutted roads (top heavy, sways a lot)." Track is heavy & slow: "Can't keep up with any unit." (e) "Size/noise--not readily hideable. Camouflage is a major exercise. (f) Operational: "Adjusting initialization parameters when changing master stations." "CPU boot up." "Switches & KYK-13." "Sitting."

113 n/a ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [73%] (a) None. (b) Trailer support unit: "Prone to flat tires in rocky terrain." "Fire extinguisher falls off." "Storage box doors & engine access doors do not remain closed." (c) Weight, "strain on carrier." (d) "Data link antenna elements break off." (e) "Power cable collects mud." (f) Rear step gets damaged when making sharp turns with TSU connected.

114 n/a WHAT ARE THE MOST DIFFICULT ASPECTS OF OPERATING THE TRAILBLAZER SYSTEM? [87%] (a) "Setup/teardown; camouflage." (b) "Collective protection equipment; ground rod driver." "Climbing around on top of shelter in order to deploy all antennas, & connection/removal of main power cable." (c) "Being uncomfortable in chair." "Working in such a small, uncomfortable area." "Being cold & hot at same time--cold feet, warm upper body & head." "Headsets (H-161D/U) hurt ears & head with prolonged use." (d) "Remembering all the functions." "Remembering to have all switches in right positions." "Trying to use RCDU for intercept/search operations." "Getting everyone netted in a timely manner." (e) "Troubleshooting, not knowing what to do when something goes wrong." (f) "Occasional lack of teamwork." (g) "Nothing."

117 n/a WHAT SOFTWARE CHANGES WOULD YOU LIKE TO SEE? [60%] (a) "DS PLAN: ability to activate only specific frequencies, but still have others listed; preset frequencies that can be quickly scanned; not just one 'saved' frequency. EDIT: Get rid of edit mode; make changes by typing in changes with the command but not having to 'go to' edit mode first [see also

TABLE 2.9(3) (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		Table 2.9(6), item 18]. GIST & SCRATCH PAD: Like to see a command available to take you straight from test entry to command mode; i.e., [with] TEXT prompt displayed, enter RTC (return to command) or anything not likely to be entered as text. Help function should be within each mode & not a unique selection, i.e., if operator is in a particular mode & needs help, operator enters command for help, & options at present point of operation are given, leaving system in that mode. This is as opposed to exiting mode operator is working with, accessing help file & researching area in question, then returning to desired mode & starting over; similar to what is now available with message help feature. Need ability to select a specific page, not just first or last or having to page through to desired page. This is pertinent to directory & system status primarily, but also GS ACT, & anywhere else where multiple (more than 4) pages are likely to be found." "Need much more flexible gist functions." (b) TCAE (TCAC) Reporting procedure: "Very awkward." Reports must be sent with exactly correct format (with Zulu time, etc.). Yet there will be times when information is very perishable. For example, "when I overhear that a counterattack is going to begin in 15 minutes, I want to pass this immediately to my battalion without spending 15 minutes putting report in right format, as if I [were] going to be graded on it. There should be some 'flash message' [with] simplified format built into software so that messages can be sent in 60 seconds if necessary." (c) DF files should be set up so that operator can designate files by frequency, [as it is] done in Guardrail & Quickfix. This would allow for more than one file on a specific frequency [and] allow more threat emitters to be located; [would] also make it easier to determine movement of same." (d) "LOB verification--if an erratic LOB is submitted during system operation, it should be thrown out automatically so that a fix is provided." (e) "Expand maximum number of fixes computer will hold from 10 to about 200. Often you need to check on a fix that came [in] five or 6 hours earlier & is not there." (f) "Message formatting, [which was trained but not tested], was very unwieldy & time consuming; editing & corrections are very hard to accomplish." (g) Miscellaneous: "More speed, user friendliness." "A workable escape key." "A trouble-shooting help page." "A turbo mouse (or joystick) would be quicker."

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2.9.4.1.1.2 (U) Operator interview findings. Tables 2.9(4) through (6) organize human factors findings obtained from operator interviews conducted by ARI. Interview findings that were essentially identical to those obtained with the Trailblazer MANPRINT Evaluation Questionnaire are not repeated, although gratuitous comments obtained with the questionnaire that did not belong to one of the questionnaire topic areas are included here. Significant editorial additions, comments, or changes are enclosed in brackets.

TABLE 2.9(4) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS OUTSIDE THE SHELTER

No. Topic: Gist of comments

01. TRAILER SUPPORT UNIT: (a) Engine compartment covers: Easy to pinch fingers when folding covers up. Locking hasps are so located that it is difficult to lock covers open & more difficult to release them. (b) [Because of difficulty of seeing into battery cells to check fluid levels during PMCS, one operator was observed checking levels with a bare finger--potentially dangerous.] (c) Grease fittings on legs have no release valves, which tends to produce a vacuum lag that freezes up locking mechanism & makes it difficult to move legs. (d) A number of flat tires occurred, perhaps related to incorrect inflation pressures. (e) If mud freezes on power cable connectors during transit, it might be very difficult to remove connector caps.

02. M1015A TRACK VEHICLE: (a) "Most unsafe feature of system is possibility that track will start moving accidentally during operations, especially when on-board 60 kW generator is in use. There is no way to lock transfer case in neutral." (b) Lock-open latches on side of vehicle for securing tailgate in open position did not hold at all [on at least one set]. Very dangerous in a wind--[heavy mass of door swinging around could cause injury to personnel]. (c) "Checking oil level for final drives is difficult. Left dip stick is angled so that it is easily bent while removing it; & right one, located deep underneath cab floor is hard to reach & turn; it puts operator off balance; [one of the other operators] could not do either left or right."

03. GROUND ROD DRIVER: (a) "Very dangerous. I would rather drive by hand if time were not critical." (b) A ground rod driver cup was missing from one of the units. The cup is a loose part that can become lost. If lost, task of setting ground rod may be more difficult & time consuming, since it would have to be done by hand with a sledge or by burying.

04. GROUND STRAP & CLAMPS: (a) Ground wire on M1015A is too short. Consequently, location of vehicle is greatly determined by location of ground rod. This may make site determinations very difficult in some terrain-soil combinations. A longer strap [or easy availability of an extension] would help to alleviate this problem. (b) There is no designated or adequate place to stow alligator clamp on M1015A during transit. Therefore clamp tends to fall down & get broken off by brush or other obstacles. (c) Clamps won't accommodate all of cable wire once it gets untwisted somewhat; therefore, only part of strands may be connected to clamp.

05. EXHAUST PIPE, HEATER: Regarding cargo area heater exhaust pipe (forward of front inclinometer), TM 9-2350-247-10 states (p. 1-3, change 2) that there are "guards to prevent injury to personnel or damage to cargo compartment cover." However, there were no apparent guards, & exhaust pipe is in a position that makes it a very tempting handhold for climbing to deck behind cab from roadside. If pipe is cold, it could be damaged if used as a handhold. If it is hot, using it as a handhold could cause injury to personnel. Other handholds are needed to reduce temptation to use this exhaust pipe.

TABLE 2.9(4) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS OUTSIDE THE SHELTER (Continued)

No.	Topic: Gist of comments
06.	OIL FILLER CUP: [An operator was observed standing on oil filler cup (near heater exhaust pipe) while working in area of shroud cover. The cup & its distribution tube are not designed to withstand weight of a heavy person.] [One oil distribution tube was observed to have been crimped, but probably from impact during shelter installation rather than from weight of someone standing on filler cup.]
07.	LACK OF OIL CONTAINER: Operators carried extra oil supplies in empty plastic soft drink bottles.
08.	DATA LINK ANTENNA: Ground plane elements vibrate loose. Tools provided are not adequate to effectively tighten them. Also, a canvas cover installed on road side would prevent tree limbs, etc. from breaking them off.
09.	WHIP ANTENNA FOR RT-524: No antenna tie downs were provided; therefore antenna was removed during transit. What about in-transit communications?
10.	SHROUD COVER RELEASE MECHANISM: Handle needs a longer shaft so that shroud cover does not come in contact with it when closed & to allow more room for manipulation of handle.
11.	ANTENNA CRANK HANDLES: (a) Crank handles used for deploying antenna group & dipole antenna are supposed to rotate as crank is turned, thus eliminating friction on palm of hand. The handles observed were "frozen," which made turning crank significantly more difficult. (b) Diameter of dipole crank is too small, not enough leverage; would be especially noticeable in freezing weather because handle freezes up. (c) There is no indication on or near cranks that shows which way they are to be turned. There is a directions plate for antenna group handle behind & to left of operator, but, not unreasonably, operators do not stop to read them. Instead they determine proper direction of rotation by trial & error, during which process, they tend to become somewhat confused because response of antennas to turning cranks is not immediate enough to know instantaneously whether or not crank is being rotated in correct direction. [Small directions plates near handles, where they will be noticed, would help.]
12.	ANTENNA GROUP STOWAGE: Occasionally antenna mast would not retract completely, remaining extended a few inches. Ordinarily this would be noticed by operator when mast transport retaining fastener would fail to latch. However, as is often the case, retainer cannot be brought into latching position because of weight of mast on mechanism. Hence, operator sometimes has to crank antenna into stowed position to alleviate weight prior to latching retainer. If mast has not retracted completely during this maneuver, there is great risk of damage to antenna, which will bang against framework of brush guard & shroud.
13.	DIPOLES DEPLOYMENT: Typically, operator stands on back part of cab framework, which is neither designed for nor well-suited to that use.

TABLE 2.9(4) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS OUTSIDE THE SHELTER (Continued)

No. Topic: Gist of comments

Besides causing damage to frame--"I have seen it break [and] one of the frames used in test is bent badly--maybe two feet"--it is a safety hazard. Operator could easily slip & fall. There should be a specific, secure place to stand.

14. SADDLE CLAMP HINGE BOLTS: In open position of clamp, two opposing sets of six bolts each contact each other in a way that may damage bolt threads.

15. MAST EXTENSION SWITCH: (a) Would be better labelled "UP--HOLD--DOWN" rather than "OUT--PAUSE--IN." The former are more intuitive. (b) Operator's manual instructs operator to leave switch in PAUSE during operation. Then, if power is inadvertently or purposely cut & then restored, antenna will not extend itself automatically. If, however, operator has left switch in OUT position, mast will extend automatically, which may be undesirable. A solution would be to use a "deadman" switch that would automatically return to PAUSE position when released by operator or when mast reaches its fully extended position.

16. MAST HYDRAULICS BOX: (a) Velcro fasteners for box cover are extremely difficult to attach because of insufficient space for hand. As a result, cover is rarely secured adequately. [It has been observed to fall off during transit.] (b) Checking hydraulic oil level is cumbersome & time consuming--"should be a lot easier."

17. MAST AIR HOSE: Operators should be cautioned to observe air hose while mast is being retracted; hose can become entangled if it gets out of proper alignment, as it might in a brisk breeze.

18. RF CABLES: The three heavy RF cables coming from antenna group snake through antenna-mast joint in such a way that cables can rest directly on rotating shaft of antenna group deployment crank. Rubber insulation on observed set was worn through, which exposed wire shielding underneath.

19. SHELTER ACCESS: (a) "Need a handle at door to aid in hoisting oneself up into shelter." (b) "Door should lock & release from bottom so that you don't have to climb up." (c) Handle is difficult to operate because of its angle & operator's position. Handle is angled 45 degrees to left in closed position & must be moved 90 degrees to right to open. It is very difficult to close completely, which makes it hard to install shelter padlock.

20. MOPP-IV SETUP: "Relatively easy with exception of installing guard receiver antenna elements, which were difficult to turn wearing rubber gloves."

TABLE 2.9(5) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO EQUIPMENT INSIDE THE SHELTER

No. Topic: Gist of comments

01. MAIN POWER SWITCH (power distribution box): Excessively large. Requires two hands & considerable strength. "Couldn't a simple [guarded] three position toggle switch could do same job?"

02. POWER DISTRIBUTION BOX--ACCESS PANEL DOOR SCREWS: Operator needs frequent access because of "unreliability" of generator & possibility that breaker may switch off. But also, door needs to be kept closed during operations to prevent accidental switching off of system power. So, operators seldom engage more than one of the nine door screws.

03. POWER DISTRIBUTION BOX--POWER SUPPLY FREQUENCY METER: Meter is extremely difficult to read in low light & difficult to read in good light. Problem results from type of indicator, which is a vibration in one of a horizontal series of piano-key-like rectangles.

04. POWER DISTRIBUTION BOX--CIRCUIT BREAKERS: Couldn't a single switch take place of several for a normal (default) power-on sequence? That is, keep present switches (or any appropriate subset of them) set to ON, & control them with a master switch. Is it really necessary for operator to switch each breaker individually every time?

05. LIGHTS SWITCH: A better location, perhaps, would be on front of main panel somewhere.

06. AIR CONDITIONER: "Caution light for climate control does not come on until system has already suffered some detrimental effects such as keyboard locking & plasma display irregularities. Same thing happens if it gets too cold."

07. COMPUTER RACK: [Top of rack forms an inviting shelf for storage of various items, including coffee cups, soft drinks, etc. The "shelf" was observed to be used for these purposes.]

08. OPERATOR POSITION DESIGNATION: [It is customary to number from left to right. Here, position 1 is on right while position 2 is on left. Caused some confusion at first.]

09. WRITING SHELVES: (a) Papers laid on shelf for position 1 can be accidentally shoved back & lost behind equipment. There needs to be a barrier. (b) "Shelf is too high for me, & a left-handed operator at position 1 has to use shelf meant for position 2."

10. DISK MEMORY UNIT: There are five indicator lamps on DMU: SELF TEST (yellow), RDY 0 (green), RDY 1 (green), PSOK (yellow), & BUSY (yellow). It is difficult or impossible to distinguish between their on & off states when shelter door is open because of ambient light. Problem is more severe with the three yellow lights.

TABLE 2.9(5) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO EQUIPMENT INSIDE THE SHELTER (Continued)

No. Topic: Gist of comments

11. KEYBOARD: (a) Not current standard; old fashioned. Keys in non-standard positions, etc. (b) Small 'carriage return' key; plenty of room for a larger one. (c) "Needs a keypad because we enter a lot of numbers (frequencies, distances, grid coordinates, times, dates, etc.)."

12. RECEIVER CONTROLS--FREQUENCY TOGGLES: Not user friendly; ineffective; aggravating; uncomfortable to fingers. The four toggle switches & fine tuning are very monotonous & tedious after a few hours--& time consuming. The 10ths switch, the one used most, is very close to fine adjustment knob; so, frequency gets knocked off. To go through thousands of milli-increments to tune a tactical frequency is a lot of effort for minimal returns. Improved method for selecting frequencies is needed, such as a "rate cursor" with a rate button that aligns cursor over digit to be changed. "Best solution from my experience is a cursor rate button--independent control over digits, at least 100ths & 1000ths digits. Only one column in frequency should change at a time." Even rocker switches instead of toggles would be an improvement.

13. DATA LINK RECEIVER: Sends out constant pulse signal. Eventually will be targeted by other side. There should be some way of remoting data link away from shelter to increase survivability of system & operator. Even 50 or a 100 meters better than nothing. "Doctrinal application for system is that we're supposed to be so far back that remoting is not a factor. But I would like a remote capability. I would want that more than the CPE stuff."

14. WATTMETER (M2): This meter has two scales, for measuring forward & reflected power of reporting link & data link transceivers & data link antenna. The scales are not labeled & are situated one above the other. [During performance evaluations, students almost invariably confused the two scales. They need to be properly labeled.]

15. INTERCOM CONTROL: (a) An operator at position 2 complained that volume was too loud & could not be attenuated sufficiently. (b) Volume control knob for position 1 was rotating freely--one allen screw was missing & the other was loose. No tool was available.

16. TOOLS: No allen wrench for operators to tighten loose knobs. Could be a serious shortcoming in some instances. For example, on one KY-57 unit, left-most control knob kept coming off during test. If knob is loose or lost it may prevent operator from pulling control over detent for purposes of zeroing.

17. VOICE RECORDER JACK: This connector protrudes out onto operator's writing shelf & cord bends sharply.

18. FOOT SWITCH (RT-524): "I sometimes have a problem finding switch--usually interrupts my mission. Foot switch should be an operator option. There should be a clicker on headset cord or somewhere convenient."

TABLE 2.9(6) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO OPERATIONS & INTERFACE SOFTWARE

No. Topic: Gist of comments

01. POWER ON PROCEDURES: Suggestion: Provide a checklist (like a pilot's checklist). Would be especially useful for operators who have not used equipment for a while. Operators are moved from one system to another frequently, & there is a certain pressure to perform rapidly--not always for tactical reasons, but also for "impressing the COL," etc., ("crew drills") in garrison. Such a list would also be useful for trouble-shooting. Mount list inside shelter.

02. POWER TEST: According to operator, training had included instructions not to have both data & reporting link radios on while testing power output--otherwise, there is a possibility of damaging equipment. Systems should not have to depend on operator memory to avoid self-damage or destruction; system design should anticipate operator errors & incorporate protective features.

03. TRAILBLAZER LOGO: Designation for Trailblazer system tested during IOTE was AN/TSQ-138. Plasma scope logo has older designation AN/TSQ-114B(V)2. Why any logo at all?

04. ZULU TIME: [Entry of correct zulu time was sometimes problematical, especially when local & zulu times were on different dates. It would be helpful if operator could simply enter number of hours to be added (or subtract) from local time by computer to produce correct zulu time & date. Better yet, would be a reliable internal clock that would maintain correct time & date (including local & zulu) during system power off periods.]

05. NETWORK PARAMETERS PAGE: Why must operator type in spaces (or commas) between numbers when entering queuing orders? They seem to serve no purpose.

06. HELP FILE: (a) Help file should have a trouble-shooting menu & accompanying information. For example, if you can't net with another station, computer should ask operator: "Is KY-57 erroneously set to LOAD position?" "Are data line & reporting link radios on?" Etc.--whatever is appropriate to situation. (b) "Help function is nice, but can't be accessed without getting out of current mode (e.g., directed search edit)."

07. LACK OF ESCAPE FUNCTION: (a) "Whenever message 'Enter frequency' appears on command line, then you cannot go to another function (i.e., escape) unless you enter a frequency that is in data base. [If you try, you get the] message '1310**Function keys are not a valid input now.' You should be able to override with some sort of escape." (b) "In gist edit, to exit from a 'text' command, you must hit CR twice. Obvious methods (e.g., 'ED,' 'EX,' 'HELP') don't work. [Operator must enter a response that has no mnemonic value.] Again an escape button would help."

08. MESSAGE NO. 759: [Message is: "Incoming Directory is Emtpy (sic)." Note misspelled word.]

TABLE 2.9(6) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO OPERATIONS & INTERFACE SOFTWARE (Continued)

No. Topic: Gist of comments

09. DATA BASE CHARACTERISTICS: (a) "Term 'Unit Designator' on gist file & LOB displays is a misnomer. It really means something like 'Identifier.' 'Unit Designator' is misleading, & students misunderstand it. On LOB display, term 'FIX ID' might be better." (b) "Gist count in DF directory gives only number of lines of gist per frequency, which is not very useful to operator. Very useful (a significant improvement in system) would be a listing of 'unit designators' (gist ID's) for a given frequency. This would provide continuity of mission between operators after shift changes--would allow second operator to continue first operator's work."

10. ACTIVITY PAGE. Somewhat confusing. In an active RF environment, information value of activity counts may tend to degrade. When interval between first & last intercept times becomes long, activity pattern for a given frequency is obscured. Cannot determine periods during which frequency was most active. A high count may indicate sustained activity during entire interval or relatively more intense activity at beginning, middle, or end of interval. Without special effort, operator will probably not be aware of pattern of activity of certain frequencies that show up on activity record. A partial solution would be a more versatile flag function that would indicate time of most recent activity; this would be faster than using restrictive parameters.

11. FLAG CHARACTERISTICS: (a) Current method not adequate. It does not attract operator's attention amid clutter of other visual stimuli & physical activity. Just a visual cue up at top of plasma is not sufficient. There is no accompanying audio tone. (b) "'Activity' flag designates last active frequency, but because it does not go off when frequency becomes inactive, it does not necessarily indicate a currently active frequency, which is what you need. Thus, in a sense, term 'activity' is a misnomer. Flag should go off when activity ceases.

12. COMMAND TERMS: [Some terms are indistinct from one another & confusing to students. During final post-training operator performance examinations, operators were observed confusing commands on many occasions. An illustrative set of terms is found on pages 2-153 & 2-154 of operator's manual, where the following instructions are provided:

1.	To activate	DS,	type:	ACT DS
2.	To deactivate	DS,	type:	DEACT DS
3.	To access	DS data,	type:	DS ACT
4.	To clear	DS data,	type:	DSACT

Such closely related commands are likely to be confused by students regardless of quality of their training. Something like the following would be considerable easier for students to become accustomed to & to retain without future confusion:

TABLE 2.9(6) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO OPERATIONS & INTERFACE SOFTWARE (Continued)

No.	Topic: Gist of comments			
1.	To begin	DS,	type:	BEG DS (or START DS)
2.	To end	DS,	type:	END DS (or STOP DS)
3.	To display	DS data,	type:	GET DSD (or SHOW DSD)
4.	To clear	DS data,	type:	CLR DSD (or DEL DSD)]

13. SCREEN LABELS AND HEADINGS: (a) On certain graphical displays, fix numbers & set numbers are difficult to distinguish from one another--they are both represented with arabic numerals. One solution would be to represent Trailblazer sets with alphabetic characters A, B, C, etc. (b) Other labels and headings could also be improved to maximize mnemonic value; for example, substitute STA-ID (or S-ID) for SIDN ("station identification number").

14. AUTO TUNE [see also item 17(a)]: (a) "Auto tune automatically sets bandwidth to 8 kH, which is often too narrow to receive a clear signal without time-consuming adjustments." (b) "Need manual attenuation adjustment so you could specify signal strength--high, low, or medium. Normally would want to block out weak signals."

15. NATO TONE REJECTION: Trailblazer does not have a NATO tone rejecter, which would be real handy--when you're searching, you could get rid of a lot of garbage ('friendly' signals), which clutter up your general search activity screen [see also item 17(c)]. The more data contained in the GS activity catalogue, the longer the CPU takes to produce activity screen [see also para 2.9.4.1.2(d) & Table 2.9(7)]. An optional NATO tone rejecter would save operator a lot of time.

16. RECALL FUNCTION: "You can only save one frequency for recall with recall button, which is analogous to having only one preset frequency on your stereo system. Constantly having to manually tune to other frequencies causes lost time."

17. SEARCH: (a) [This comment has been edited; it retains the operator's meaning.] "In Trailblazer, directed search is done by computer. On certain other systems you can program in step frequencies, &, while you listen, the system scans them in a specified order, dwelling on each a specified amount of time. You also have sector frequencies & ability to lock out; you can lock out NATO squelch frequencies to orient yourself to systems other than US/NATO. Every time one of the frequencies comes up, if there is something you want to hear more of, you just hit a button & lock into the signal. Once the signal goes down or you're done, you hit another button, & the computer resumes its scan. On Trailblazer, however, you can't listen to the frequencies that are being scanned. When [or if] you notice the flag, you hit the AUTO TUNE button to tune to the active frequency. Whatever was on your receiver is lost (unless you hit SAVF instead of AUTO TUNE). You should have the option of being able to listen while computer scans set of preprogrammed frequencies (step frequencies) with restrictive parameters (bandwidth, etc.). By the time you notice flag & hit auto tune, & it tunes up or down for a couple of seconds, you've lost a call--he may have been just coming up with a code word

TABLE 2.9(6) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO OPERATIONS & INTERFACE SOFTWARE (Continued)

No.	Topic: Gist of comments
	or something that's important to your mission. By the time you've done all that, if he's smart, he's not going to be on air anymore. To me, its easier if you're listening to what's going on. That's what we [as 98Gs] do. We listen. We're not over here taking visual cues (from spectrum display). Furthermore, the system is too sensitive; it picks up a lot of stuff that has to be excluded. The advantage of step frequencies that you can listen to is that you know what you're looking for--you've been tasked. You put those in, & all the rest of that junk is not even a factor. Bottom line: Incorporate ability to program step frequencies & dwell time into receiver; then when you hear it & want it, you push a button & you're locked into the frequency. When you want to resume search, you hit another button & stepping resumes. You should be able listen while it is stepping." (b) "DS activity page only provides history--it should have real time indicators." "A big problem is that there is no real time tuning with RCDU--I have yet to hear an operator say anything good about it. Scope is not real time--display & tuning knob are not synchronized well enough, so what you see & what you're trying to do with knob don't correspond closely enough; can miss signals easily." (c) "There is no way to set a limit on signal strength threshold during general search. Therefore, activity table gets full of undesirable emitters (i.e., signals too weak to hear). It is much too sensitive. & there is no content--no way to tell 'friendly or foe' (no IFF)." "Auto tune may flag a weak signal before it [gets a chance to] flag a strong signal. So you may miss stronger signal. Should be able to set sensitivity of search capability." (d) Need to be able to listen & to set search speed, so operator can decide whether to continue listening or not. (e) "'Scan' function in general search is very limited. Only way to monitor active emitters is by pressing auto tune function key--if there is no activity present in directed search or directed search is inactive. There should be a way to monitor activity in GS--operator should have a receiver control more like that in AN/TRQ-32V." (f) "You should be able to access a particular frequency on activity page without having to switch modes first & therefore having to hold frequency in mind." (g) "You can enter up to 125 frequencies into DS plan. Then you have two choices: Activate all or none. If you only want to search a few of interest, only way to deal with those & those only is to have them be only frequencies in DS plan. This means that every time you change priorities, you have to remove previous frequencies & enter new ones. It would be nice to be able to enter a tasking with a large number of frequencies & then be able to work with a few at a time. Otherwise, you keep getting prompted on frequencies in which you're not interested."
18.	COMPUTER FEEDBACK: [See additional feedback comments at item 19.] Error message "You forgot . . . [such & such]" should name all missing information (e.g., "lines 5 & 17") at one time instead of naming one item at a time. In current sequence of events, operator receives message "You forgot line 5," & after line 5 is entered, another message, "You forgot line 17," appears--and so on.

TABLE 2.9(6) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO OPERATIONS & INTERFACE SOFTWARE (Continued)

No.	Topic: Gist of comments
19.	COMPUTER SPEED [see also item 20 & Table 2.9(7)], THE EDIT COMMAND, & FEEDBACK: [See additional feedback comments at item 18.] (a) [The following comments have been edited]: "The function keys have a lag of a second or two. If you're in one mode & you want to change to another--e.g., if your in DS plan & you want GS plan or you want to gist or you want to call anything else up--there's a delay of at least one second. This causes a problem; when you press button, you don't see result immediately, & you're in a hurry, so you press it again, thinking it didn't 'take.' Consequently, you have entered command twice. For some commands this doesn't matter, but with EDIT command, it does. If you're in EDIT mode, you have to get out of it before you can enter a major command to go to a different function. So, you try to exit EDIT by pressing EDIT function key, & during subsequent delay you think, "I didn't press it hard enough; it didn't take." So you press it again, & finally it rolls over & goes out of EDIT--but then it goes right back in again because command was pressed twice. Who knows how many times an operator will press the button under these circumstances? Suppose you get a flag, & you auto tune to it, & you're still in edit. You hit EDIT twice, & it causes confusion & delay because you're accumulating a second or two delay for each time you hit button. So you've just lost two to three, maybe four seconds now, & your signal might be gone, & you still haven't accessed gist page to copy down what you wanted to. You can get DF--that's no problem. But you also want to get intercept." (b) "I feel it's faster [but see Table 2.9(7)] & better to type edit command (ED) at keyboard. You've already got you're fingers there. You can type edit or exit to get out of edit. Difference between using keyboard & using EDIT function key is that when you type ED & hit CR, you see what you typed disappear from screen--edit page is still there but, you know it accepted command because you saw command disappear, & you know you're ready to type in next command. You've already got your fingers over keys to type in "GI" [for gist] as soon as command prompt comes up. That is by far the fastest way to do it. With EDIT button, you don't get any feedback until it has completed its course of action." (c) "The reason this is so important is that all the locations (fixes) in the world do you no good if you don't know who is at the location. It's what you put into that gist page--'so & so talking to so & so, & this is what he said'--that identifies the target. That is just as important, if not more so, than DF. The commander wants to know who's where, not just a bunch of locations. The 'who's who' in electronic environment game." (d) "Thus, edit key, & perhaps others, have disadvantage of not providing sufficient feedback about what computer is doing. The keyboard, however, does not. For example, when you're in edit mode, EDIT button is lighted. If light went out after you pressed button, while computer was processing command, that would be feedback. But it doesn't. Light stays on until command is completed."
20.	COMPUTER SPEED [see also item 19 & Table 2.9(7)] & REMOVING INCONSISTENT LOB SETS: "Amount of time required to remove inconsistent DF sets from 'unassigned' section of LOB file is extremely excessive. Operator must display LOBs, enter edit mode, select unassigned set, DFIX (remove information in unassigned file), & exit edit mode. It is necessary to remove information

TABLE 2.9(6) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO OPERATIONS & INTERFACE SOFTWARE (Continued)

No. Topic: Gist of comments

because you can't gather any more until it's gone; and you may need more information because, after viewing the five sets (unassigned file will hold only five inconsistent DF sets), you still may not be able to determine why you did not get a fix--which was the purpose of looking at the unassigned file]. Now you're ready to try again, but encounter delay [of removing unwanted data], & emitter signal may be lost. What is needed is a way to quickly purge unassigned file."

21. LACK OF LINE WRAP: (a) Theoretically, operators are touch typists--they do not have to look at keyboard. This is supposed to allow them to concentrate on screen. In practice, however, it doesn't work that way: "Whenever I'm listening to something intently, especially this [sort of thing], I'm not [always] going to be focusing my eyes on screen to make sure when to hit CR to go to next line." Plasma screen allows operator 73 characters per line, after which a 'carriage return' must be entered to bring up next line for continuation--all characters beyond number 73 are lost if carriage return is not pressed. "So you're typing away listen to someone on radio. You've got no indication that you've reached end of line because you're not looking at screen. You're just typing off into space. It should wrap automatically." (b) If operator continues to type (after pressing CR) while computer is preparing for next line--there is a delay of a second or two--characters typed during delay are lost. "I don't understand why that happens with technology that is available today. I mean, come on! We're talking a typewriter really. That's all. With automatic carriage return. & you can keep right on typing." (c) While plasma scope line will take 73 characters, report format into which information is put will handle only 68 characters per line (58 in first line). In reality, then, operator should press CR at character 68 rather than at 73. [Screen does not have column indicators to keep track of cursor position.] Line limit on screen should be exactly same as line limit for report.

22. GIST PROCEDURES: (a) "To go from one gist message to another is very slow & cumbersome. First, you must press CR to save last gist line. This produces a new empty line with a TEXT prompt--machine is waiting for a continuation of message. Then you press CR again. Prompt flashes. Then you press CR again, & computer goes into edit mode. Then you must exit edit mode before you can go to any function. So you press edit button, which produces command prompt CMD>. Then you go to a new gist page by entering a new gist command 'GI [freq].' You cannot use GIST button here [which may be a point of confusion to operators]. If you do, it will put you right back where you were in original gist unless you had tuned to a new frequency. [The process is] much too over-complicated--'Keep it simple!' (We used to make jokes about it: There were times here, during our training, when we would call up a page of gist that had already been entered by some other operator--so we could see what had been put in--and in text of gist there would be all these different commands, like 'ED,' 'EX,' 'FO,' 'BA,' & 'LOB,' because person had been trying to get out of text mode but couldn't because you have to hit CR twice on a blank line to get out. Anything else you enter--any command--will be

TABLE 2.9(6) (U) OPERATOR INTERVIEW FINDINGS: HUMAN FACTORS RELATED TO OPERATIONS & INTERFACE SOFTWARE (Continued)

No.	Topic: Gist of comments

entered as information in your gist. It was funny because it was obvious that operator wanted out, & he wanted out bad, but he couldn't get out because every time he typed a command computer wrote it on page as if that were intercept he was getting. Operator was confused.)" (b) "Gist editing functions are very cumbersome & awkward. For example, to replace or change a word, operator must first exit text prompt with two carriage returns, which produces edit prompt; then type 'REP' & a carriage return (or 'DEL' & a carriage return) along with first & last line numbers, which erases entire line or set of lines & produces another text prompt; then retype entire line or lines; then enter two carriage returns, which gets out of text prompt & back to edit prompt; then type 'INS' & a carriage return to get into text mode, which allows operator to continue adding text to bottom of file."

23. DOCTRINE ON "PAPERLESS" SYSTEM: "I think that doctrine should allow us to intercept languages requiring transliteration [i.e., that use a different alphabet] with paper. I know that the computer, with its slow editing capability, would make me miss things. I would rather my report take a little longer [to construct] than be ridiculously inaccurate. A tactical environment would not allow one enough time to master skill necessary for spontaneous transliteration [with keyboard]. If Army wants 'first termers' to be able to do job, then allow them to use paper."

24. TCAC (TCAE) REPORTING: Certain mandatory lines must be included in report; therefore, there should be prompt on screen indicating line remaining to be filled out. As is, if operator forgets, computer will not send report message & replies 'Line ___ must be filled out.' Very time consuming. Also, should have an emergency override for sending messages fast--could be faster & more reliable than using RT-524. "TCAC, in reality, doesn't know what the hell is going on."

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2.9.4.1.2 (U) Computer delay intervals for selected operations [see also Table 2.9(6), items 19 & 20]. Table 2.9(7) shows the estimated amount of time required for the operator to accomplish certain operational tasks. The estimates were made by averaging the times required by an experienced operator during one or more trials. The total times consists of two components: one, the amount of time required for the operator's physical act of entering the required information via keyboard or function key and, two, the processing and display time required by the computer. (a) Table item 1: To access (call to the screen) a LOB display, the operator is required to press the DSPL LOB function key (or type in an equivalent command) and wait for the display and command prompt to appear. (b) Table item 2: To access a gist page requires that the operator press the GIST function key (or type in an equivalent command) and wait for the display and prompt. (c) Table item 3: Changing from the gist text entry mode (or scratch pad entry mode, since the procedures are the same) to the command mode (in which the computer is ready for a major command) requires the operator to press the carriage return key twice, type

either "edit" or "exit," press the carriage return again, and wait for the prompt. (d) Table item 4: To view a display of fix information listed by frequency, the operator types the command "DIR D2" and presses the carriage return. The amount of time required for the list to appear is greatly dependent upon previous system activity--the greater the previous activity the greater the response lag--as the table shows. Each of the hours of activity upon which the time estimates were based consisted of five Trailblazer set shooting 50 LOBs per hour (a maximum of 250 fixes)--probably a light tasking relative to an active tactical environment. The consequence of the dependency of response time upon the amount of previous activity is that the level 2 directory may, during a busy period, come to require an inordinate (prohibitive) amount of time to access. Accessing the level 1 directory is faster, because it contains less information (no fix information), but may be more difficult to use since each frequency must be individually researched by displaying related LOBs.

TABLE 2.9(7) (U) COMPUTER DELAY INTERVALS FOR SELECTED OPERATIONS

Operation	No. of trials	Operator component	Computer component	Total required
1. Access LOB display				
Command entered with function key	5	< 1.0	> 4.2	5.2
Command entered via keyboard	5	1 to 2	5 to 4	6.0
2. Access gist page				
Command entered with function	5	< 1.0	> 2.1	3.1
Command entered via keyboard	5	< 1.0	> 2.5	3.5
3. Change from gist entry mode to major command mode	5	1.0	3.5	4.5
4. Display level 2 directory				
After 2.75 min (3 pgs) operation	2	2.7	6.7	9.4
After 7 hrs (11 pgs) operation	[a]	2.4	21.6	24.0
After 8 hrs (13 pgs) operation	1	--	28.2	--

[a]The operator component was based on 3 trials, the computer component on 4.

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2.9.4.1.3 (U) Operator errors and mode switching. The IOTE was not designed to collect extensive data on operational errors or skill levels related to human factors and operator-system interface. (Message completion rates were obtained; those data are reported elsewhere.) A minimal amount of data of interest was obtained, however, from one operator who cooperated in keeping an accurate log of the number and types of errors he made during two time intervals. Because of the small sample, the results cannot be widely generalized, but they shed some light on the types of errors that are

encountered and the reasons for them. (a) During the first time block, which was two hours, the operator made six operational errors, each of which consisted of entering a correct command improperly or entering an incorrect command. "At least two of the six" were caused by system response delay--"I tried to type in the command while the computer was processing the previous command, i.e. [during] page roll over" [see Table 2.9(6), items 19(a) & 21]. (b) The second test interval was three hours, during which the operator recorded eight errors. "Three consisted of trying to enter a major command while still in the edit mode--a very easy mistake to make, even when trying to avoid errors [see Table 2.9(6), item 19]. The requirement to change modes in order to edit is cumbersome and seems like it should be unnecessary. The other five of the eight errors also involved switching modes (e.g., exiting test mode from the gist page)--so all eight errors were caused by the requirement to switch back and forth between modes." (c) The same operator also reported the following related incident in which he missed two entire messages. He had just created or changed a DS plan and forgot to exit the edit mode, as one must for the change to take effect. He was waiting for the flag to prompt signal activity, but the flag did not appear because the computer did not recognize the new frequencies. Hence, the operator was not aware that an emitter was active. The problem was related, of course, to the necessity of having to switch back and forth between modes.

2.9.4.1.4 (U) Performance times for selected operational tasks. The amount of time required for individual operators to perform many of the tasks involved in setup and operations were recorded during the operators' post-training performance evaluations. In addition, crew performance times for tasks involved in system setup (both normal and in MOPP level IV) were obtained. These data are presented in an earlier section regarding Trailblazer training (see para 2.7.4.4.4 and its subsections).

2.9.4.1.5 (U) Instructor ratings and comments. Tables 2.9(8) and (9) summarize the operations-related findings obtained with the Trailblazer Questionnaire for Instructor Personnel for outside and inside the shelter, respectively. The questionnaire was completed by three of the operations instructors. The presentation format follows that of Table 2.9(2).

TABLE 2.9(8) (U) INSTRUCTOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS OUTSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
063	5.0	HOW GOOD IS THE CPE (COLLECTIVE PROTECTION EQUIPMENT) SUPPLIED WITH THE M1015A SHELTER? WHAT PROBLEMS, IF ANY, HAVE YOU EXPERIENCED OR DO YOU ANTICIPATE? [100%]: Unnecessary--by the time you got it set up you'd be dead. "There is no integrity of seal whatsoever! It requires far too much time to deploy." In four fieldings, "have not seen a real working CPE."
062	3.7	HOW WELL SUITED IS THE M1015A VEHICLE TO THE TRAILBLAZER SYSTEM? [67%]: "Vehicle is too light to handle shelter & CPE's weight & to pull TSU." "Entire system survivability is almost non-existent in this sort of deployment!"
030	n/a	VEHICLE LEVELING GAUGES [67%]: Front gauge is a safety hazard because you must climb up vehicle to read it.
031	n/a	TSU [67%]: Potential "serious injury or death" from "electrical shock" or from accident while maneuvering TSU.
033	n/a	GROUND ROD DRIVER [100%]: (a) Unreliable. (b) Winch handle can be a safety hazard--operator must stay clear.
035	n/a	30 KW GENERATOR & ITS CONTROLS [67%]: (a) Vehicle has "tendency to jump out of gear," which could endanger lives. (b) Hearing protection required.
039	n/a	POWER CABLE INSTALLATION [100%]: Requires two persons.
040	n/a	TAILGATE [67%]: "A two-man lift."
041	n/a	HANDHOLDS for climbing onto shelter [100%]: (a) "Very dangerous" situation. "Definitely insufficient."
046	n/a	ANTENNA SHROUD LATCH [67%]: (a) "Despite directions plate, many people have fits with this latch." (b) Sometimes connecting rods do not properly release latch hooks.
051	n/a	DATA LINK ANTENNA ELEMENTS [67%]: Tend to break.
052	n/a	QUICK-RELEASE PINS [67%]: Antenna height limiter pin is sometimes difficult to remove & replace.
060	n/a	MAST EXTENSION SWITCH [67%]: Mast sometimes does not retract fully before it is lowered.

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TABLE 2.9(9) (U) INSTRUCTOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS INSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
101	4.0	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? [0%]
079	3.7	SPEED OF THE COMPUTER from the operator's point of view [33%]: "If you [type at] 35 wpm & above, computer cannot keep up, & if both operators are typing at same time & [at] same moderate speed, it will lock up one or both operator positions."
067	3.3	ADEQUACY OF STORAGE SPACE within shelter [67%]: Fair to poor; inadequate for manuals.
075	3.0	OPERATOR PANEL FOOT SWITCH [33%]: "Sometimes foot switch seems to short out when making radio transmissions."
076	3.0	AUDIO RECORDER [33%]: "It is very difficult to get proper volume for operator messages."
077	3.0	AUDIO RECORDER FOOT SWITCH [0%]
065	2.7	EMERGENCY LIGHT [67%]: "I have actually been driven to my knees by impacting that thing with my head" [see also item 066]. [One instructor reported he knew of a person (not in IOTE) who had received a brain concussion from light.]
066	2.7	HEADROOM [67%]: (a) "I am 6'2", & as third person [instructor] on set, I constantly suffer from neck aches." (b) Personnel bump their heads on emergency light [see also item 065].
068	2.7	OPERATOR CHAIRS [0%]
070	2.7	INTERCOM CONTROLS [0%]
078	2.7	READABILITY OF PLASMA DISPLAY [0%]
080	2.7	RECEIVER CONTROL AND DISPLAY UNIT [33%]: "Spectrum display is not adequate enough to even warrant its existence."
082	n/a	POWER DISTRIBUTION BOX [67%]: "There ought to be a set sequence of power-up/power-down procedures."
085	n/a	DMU & HEAD DISK ASSEMBLIES [67%]: "DMU's that system uses . . . are a piece of _ _ _ _ !!"
086	n/a	TSEC/KG-45 [67%]: "Sometimes it does not take a fill." "Partial load problems."
089	n/a	VOICE LINK TRANSCEIVER [67%]: "Dinosaur." "Need new, up-to-date equipment."

TABLE 2.9(9) (U) INSTRUCTOR RATINGS & COMMENTS: TRAILBLAZER OPERATIONS INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
100	n/a	WHAT PARTICULAR CONTROLS OR INDICATORS DO OPERATORS (OR MAINTAINERS) HAVE DIFFICULTY IDENTIFYING (BECAUSE OF LOCATION, LACK OF ADEQUATE LABELING, INFREQUENCY OF USE, ETC.)? [67%]: "The ones on RCDU, because they are seldom used."
102	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? [67%]: "Lack of appropriate support."

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2.9.4.1.6 (U) TDP data requirements--operations. This section applies the human factors operations data presented in the previous paragraphs and elsewhere to the specific operations questions posed in the TDP (TDP para 2.9.3.1).

2.9.4.1.6.1 (U) Ease of system operations (TDP DRs 2.9.3.1.1.1-8).

2.9.4.1.6.1.1 (U) Operational difficulties (DR 2.9.3.1.1.1). The operators and trainers reported operational difficulties associated with many aspects of the system, as indicated in the previous paragraphs. The most notable among them were the following:

Outside the shelter:

1. CPE: Setup; ineffectiveness; injury hazard.
2. SHELTER FOOTSTEP: Prone to damage; slippery when wet; too high.
3. NOISE LEVELS: 60 kW & 30 kW generators; safety & health hazard.
4. M1015A WITH TSU: Speed; power; steering hazard; maneuverability; possibility of accidental movement hazard.
5. GROUND ROD DRIVER: Ineffectiveness; reliability; winch handle hazard.
6. POWER CABLE: Installation; stowage.
7. HANDHOLDS: Insufficient number.
8. BRUSH GUARD RELEASE HANDLE: Unreliability; manipulation awkward.
9. MAST TRANSPORT RETAINING FASTENER: Manipulation.
10. MOPP IV PERFORMANCE: Footing hazard atop shelter; attaching TSU.
11. TSU: Attaching to carrier; mud.
12. DATA LINK ANTENNA ELEMENTS: Loss of.

Inside the shelter (equipment):

1. AIR CONDITIONING: Lack of control; uneven distribution.
2. BREAKER ACCESS PANEL DOOR: Too many screws; location hazard.
3. EMERGENCY LIGHT: Location hazard.
4. WRITING SURFACES: Inadequate.
5. TOGGLE SWITCHES (RECEIVER CONTROL): Inefficiency; discomfort.
6. SPECTRUM DISPLAY: Uselessness.

7. CIRCUIT BREAKERS: Start-up/shut-down sequence.
8. WATTMETER: Confusion between unlabeled scales.

Inside the shelter (operations):

1. QUICKFIX OPERATIONS: Inadequate system operability.
2. MODE SWITCHING: Necessity for; time delays; resultant errors; cumbersome editing procedures.
3. SEARCH PARAMETERS: Lack of fast, efficient, effective operator control & options.
4. COMPUTER SPEED: Interface too slow; produces errors.
5. GIST PROCEDURES: Lack of line wrap; cumbersome editing procedures.
6. DATA BASE: Limitations; ease of manipulation.
7. ACTIVITY PAGE: Lack of needed information.
8. FLAG: Lacks noticeability.
9. MOPP IV PERFORMANCE: Generally impaired, but within tolerance.

2.9.4.1.6.1.2 (U) Ease of operations (DR 2.9.3.1.1.2). Among the problems cited by operators, the following were most notable:

Outside the shelter:

1. CPE: Setup.
2. SHELTER FOOTSTEP: Slippery when wet; too high.
3. M1015A WITH TSU: Speed; power; steering hazard; maneuverability; possibility of accidental movement hazard.
4. GROUND ROD DRIVER: Ineffectiveness; reliability; winch handle hazard.
5. POWER CABLE: Installation; stowage.
6. ANTENNA SHROUD LATCH: Manipulation; awkwardness.
7. BRUSH GUARD RELEASE HANDLE: Manipulation; strength requirement.
8. TAILGATE: May requires two persons; obstacle with TSU attached.
9. MAST TRANSPORT RETAINING FASTENER: Manipulation.
10. MOPP IV PERFORMANCE: Attaching TSU; footing atop shelter.
11. TSU: Attaching to carrier; mud.

Inside the shelter (equipment):

1. AIR CONDITIONING: Lack of control.
2. BREAKER ACCESS PANEL DOOR: Too many screws.
3. MOPP IV PERFORMANCE: Generally impaired, but within tolerance.
4. OPERATOR PANEL FOOT SWITCH: Stick; accidental activation; unreliable.
5. WRITING SURFACES: Inadequate.
6. TOGGLE SWITCHES (RECEIVER CONTROL): Inefficiency; discomfort.
7. SPECTRUM DISPLAY: Lacks real-time correspondence with tuning knob.

Inside the shelter (operations):

1. MODE SWITCHING: Time delays; cumbersome editing procedures.
2. SEARCH PARAMETERS: Lack of fast, efficient, effective operator control & options.
3. COMPUTER SPEED: Interface too slow; produces errors.
4. GIST PROCEDURES: Lack of line wrap; cumbersome editing procedures.
5. DATA BASE: Limitations; ease of manipulation.

6. ACTIVITY PAGE: Lack of needed information.
7. FLAG: Lacks noticeability.
8. COMMANDS: Confusion among similar spellings.

2.9.4.1.6.1.3 (U) Identification of system controls (DR 2.9.3.1.1.3). A detailed evaluation of the ease of system control identification was not conducted in the absence of apparent operator problems in this area. For operators, labeling and other means of identification of system components appeared to be adequate. One notable exception was the labeling for the wattmeter, which, although a minor problem for the experienced operator, was clearly inadequate and confusing for the majority of students. Identification of system components in the operator's manual (see para 2.7.4.3) was not satisfactory with respect to cross referencing and the quality of illustrations.

2.9.4.1.6.1.4 (U) Accessibility of controls (DR 2.9.3.1.1.4), and equipment. For operators, most controls and equipment were adequately accessible. Notable exceptions were:

Outside the shelter:

1. VEHICLE LEVELING GAUGE: Too high.
2. WHIP ANTENNAS: Lack of appropriate footing, especially at MOPP level IV.
3. ANTENNA SHROUD LATCH: Cramped.
4. BRUSH GUARD RELEASE HANDLE: Small.
5. DIPOLE RELEASE PIN: Too high.
6. DIPOLE DEPLOYMENT CRANK: Too high.
7. ANTENNA LEVELING GAUGE: Too high.
8. SHELTER FOOTSTEP: Too high.
9. SHELTER DOOR HANDLE: Too high.

Inside the shelter:

1. BREAKER SWITCHES: Access panel door locked with nine screws.
2. OPERATOR PANEL FOOT SWITCH: Out of view.
4. WRITING SHELF: For left-handed operators at position 1.
3. CPU RESET BUTTON: Out of reach.

2.9.4.1.6.1.5 (U) Adequacy of work space (DR 2.9.3.1.1.5). Cramped, but overall adequate. Inadequate storage for manuals, other documentation, and personal items. Operators complained that after two hours or more the operator seats became uncomfortable.

2.9.4.1.6.1.6 (U) Noise and lighting (DR 2.9.3.1.1.6).

2.9.4.1.6.1.6.1 (U) Noise. There was nearly unanimous agreement among the operators, maintainers, and instructors that the system is extremely noisy, that the noise levels are hazardous in the absence of adequate hearing protection (which some operators indicated was not in plentiful supply), and that the security of system location could be easily compromised. The noise emanates from the 60 kW and 30 kW generators, the former (the on-board generator) being the worst. (See, for example, Table 2.9(2), item 037.)

2.9.4.1.6.1.6.2 (U) Lighting. For operators, the lighting was adequate, though somewhat unreliable owing to short bulb life and the lack of spare bulbs. The adjustable lights would not always remain in set position.

2.9.4.1.6.1.7 (U) Ventilation (DR 2.9.3.1.1.7). Ventilation itself was considered adequate. However, air conditioning control was inadequate (see para 2.9.4.1.6.2.4).

2.9.4.1.6.1.8 (U) MOPP IV operations (DR 2.9.3.1.1.8). Outside the shelter: hazardous in the dark, especially atop the shelter; difficult to perform operations necessary to hitch the trailer support unit to the M1015A carrier. (See Table 2.9(2), item 067.) Inside the shelter: generally "miserable," as one operator put it, but "no extraordinary problems." (See Table 2.9(3), item 116.)

2.9.4.1.6.2 (U) Operator discomfort due to interior shelter temperature (TDP DRs 2.9.3.1.2.1-4).

2.9.4.1.6.2.1 (U) Shelter temperature (DR 2.9.3.1.2.1). [Provided by test directorate.]

2.9.4.1.6.2.2 (U) Outside temperature (DR 2.9.3.1.2.2). [Provided by test directorate.]

2.9.4.1.6.2.3 (U) Effect of shelter temperature on performance (DR 2.9.3.1.2.3). Appeared to be minimal, although mentioned as one of the most difficult aspects of operating the system.

2.9.4.1.6.2.4 (U) Regulation of climatic controls (DR 2.9.3.1.2.4). Control of shelter temperature was inadequate. Frequently, the operator at position 2 (against the back wall) was uncomfortably cold while the operator at position 2 was uncomfortably warm. One operator wore long underwear (in 100+ degree outside temperature) to compensate.

2.9.4.1.6.3 (U) Minimization of operator-induced failures (TDP DRs 2.9.3.1.3.1-3).

2.9.4.1.6.3.1 (U) System failures (DR 2.9.3.1.3.1). [Provided by test directorate.]

2.9.4.1.6.3.2 (U) System contribution to operator-induced failures (DR 2.9.3.1.3.2). (a) The time-consuming components of system setup, which were primarily system dependent, prevented the operators from performing setup procedures within a 20-minute criterion. (See Training Issue, section 2.7, para 2.7.4.4.4.2.) (b) Mechanically, the system also contributed to the many other undesirable consequences and conditions--some relative minor, other significant--specified in previous paragraphs. (c) The operators cited software inadequacies as a factor contributing to operator performance errors and to a consequential mission performance level that was below their personal standards. Specifically, the requirement to switch modes frequently, cumbersome editing procedures, the display lag cause by a very slow screen response, the lack of line wrap, the confusion among similar commands, the lack of an efficient escape key function, the necessity to exit initialization with a carriage return, the inadequacy of memory and data base manipulation, and other factors caused operators to lose data, to fail to effect desired

results in a minimum amount of time, to enter incorrect commands, and to fail to detect emitters. In general, while the operators were not disdainful of the computer's DF capabilities, many of them expressed frustration with the interface software as being archaic and preventing them from doing the kind of collection job they would like to do.

2.9.4.1.6.3.3 (U) Contribution of controls, indicators, and operating lights to system failures (DR 2.9.3.1.3.3). Among the many controls, indicators, and lights, the failure or inadequacy of which could contribute to a less than optimally functioning system, the operators noted especially the following: (a) The lack of a finalized determination of the proper sequence of circuit breaker switching, to which they attributed occasional system failures (e.g., disk crashes). (b) The inadequacy of warning indicators, especially in connection with the air conditioning, which allowed system degradation prior to warning. (c) The flag indicator of emitter activity would sometimes go unnoticed, thus causing of loss of collection and DF data. (d) Loose knobs, with no tools to tighten them, could result in a significant shortfall, as, for example, the inability to zero security equipment. (e) The inadequacy of the frequency toggle switches in providing a fast and easy method of tuning the receiver, which could result in missed data. (f) The problematic foot switch for the communications link. (g) The time-consuming effect of the absence of an "escape" key.

2.9.4.2 (U) Human factors aspects of Trailblazer maintenance.

2.9.4.2.1 (U) Maintainer ratings and comments.

2.9.4.2.1.1 (U) Trailblazer MANPRINT Evaluation Questionnaire. Tables 2.9(10) and (11) summarize the comments of four maintainers obtained with the Trailblazer MANPRINT Evaluation Questionnaire for outside and inside the shelter, respectively. The format of the tables is the same as that of Table 2.9(2).

TABLE 2.9(10) (U) MAINTAINER RATING & COMMENTS: TRAILBLAZER MAINTENANCE OUTSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
053	4.2	DATA LINK ANTENNA ELEMENTS [100%]: "Many threads are stripped, & many times elements unscrew themselves or are broken off [because of] shaking of shelter in transport & lack of antenna clearance when stowed" [see also item 052]. "Screw-in type are too rigid & easily broken."
049	4.0	BRUSH GUARD RELEASE [100%]: (a) Safety hazard; needs to be metal rather than plastic. (b) "Doesn't hold in open position." (c) Hard to find replacements.
066	4.0	CPE (collective protection equipment) [100%]: (a) Too heavy. Mounts of aluminum alloy break easily. "Seal does not work at all." "Junk; haven't seen one work yet." (b) No maintenance training provided.
067	4.0	MOPP IV PERFORMANCE outside shelter [50%]: (a) "Safety atop shelter would be my biggest concern. MOPP gear is in no way streamlined for monkeying around 10 feet off ground." (b) "Repairs to any equipment in EMI would be impossible; it is very difficult to disconnect cables [even] with bare hands because of cramped area, & gloves wouldn't fit."
036	3.8	60 KW GENERATOR & ITS CONTROLS [100%]: (a) "Not able to run for any length of time in case of TSU failure." (b) "Unreliable & dangerous to operate." (c) "It is blamed for crashing hard discs."
048	3.8	ANTENNA SHROUD LATCH [100%]: (a) "Poor design." "Easily broken." "Mechanically insufficient." "Springs & mechanism over stressed." Replaced 10 latches in three months. (b) Needs label to show turn direction--operators would turn in wrong direction & then complain that it didn't work.
052	3.8	ANTENNA GROUP CLEARANCES when deploying or stowing [100%]: [See also item 053.] (a) "Lack of clearance usually causes data link elements, dipoles, & RF processor, MFC, etc. to be unnecessarily damaged." "Antenna is too bulky & will sag after continued use [because of] weight of intercept group." (b) "Closing shroud cover shears off retaining screws on EMI." (c) [On one system], "shroud latch will not catch at all because cover can't close." "Does not completely stow."
037	3.5	NOISE LEVELS [100%]: "Entirely too loud." "Not enough adequate hearing protection provided." "Enemy will have NO PROBLEM locating us!"
041	3.5	TAILGATE [75%]: (a) Difficult to perform maintenance functions with TSU connected to carrier. "Tailgates should all be hinged on right, so shelter can be accessed without dropping TSU. Set with reversed tailgate experienced delays in nonessential maintenance because it was not efficient to drop TSU for a minor repair." (b) "Hard to lubricate." (c) "Temperamental."

TABLE 2.9(10) (U) MAINTAINER RATING & COMMENTS: TRAILBLAZER MAINTENANCE OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
044	3.5	EXHAUST PIPE, ENGINE [75%]: (a) Burn hazard to operators climbing onto shelter & when standing on deck behind cab to raise antenna. (b) "Too close to passenger in cab." (c) "Messy" [because of soot].
047	3.5	MAST TRANSPORT RETAINING FASTENER [50%]: (a) "Too hard to move." "Easily misaligned." "Bends when [struck] with TSU mega wrench in effort to open or close it." (b) "Hard to find replacement parts."
064	3.5	M1015A TRACK VEHICLE (Suitability for Trailblazer?) [75%]: "In hilly terrain, M1015A is nearly defeated. Trailblazer system is too heavy for a M1015A." "M1015A is not a suitable vehicle . . . . too high . . . & ride & stability are not good enough for security of sensitive equipment."
065	3.5	STEERING THE M1015A TRACK VEHICLE [25%]: [Keeping] "even tension on laterals is a problem."
033	3.3	GROUND ROD DRIVER [75%]: (a) "Junk, never works." "Seems to work well only after a torrential downpour in soft ground or sand. I think it is an unnecessary luxury." (b) "Not used."
034	3.3	GROUNDING STRAPS/CABLES/CLAMPS [100%]: (a) Ground connections should employ large alligator clamps (some were missing & none were available as replacements until well into test. (b) No spare cables for ground rod.
050	3.2	CRANK HANDLE FOR ANTENNA GROUP including shear pin [75%]: (a) "Does not allow for stress of continued use." "Antenna is too heavy" [for it]. (b) A label showing proper direction of rotation "would help save wear & tear on gears"--handle cranks in direction opposite to expectations.
042	3.0	HANDHOLDS for climbing onto shelter [75%]: (a) "When in MOPP gear, hand/footholds need to be much larger!" (b) "Shelter handhold on curb side toward front of shelter would help because tie down (which is all there is to grab) is right by exhaust pipe." "Need some."
043	3.0	FOOTSTEP for entering & leaving shelter [75%]: Bent, broken, not securely attached [had been jerry-rigged with wire]. High off ground for soldiers of shorter stature--"couldn't there be a second step a little lower?"
051	3.0	CRANK HANDLE FOR DIPOLE ELEMENTS [25%]: Proper direction of rotation for deploying & stowing is not obvious; a label would help.
056	3.0	ANTENNA HEIGHT LIMITER [25%]: "No real purpose."
061	3.0	MAST HYDRAULICS [50%]: (a) "Somewhat slow in operation." (b) "Insulating cover insecure. If it is considered necessary, it should be cut to fit metal lid only & be permanently affixed."
045	2.8	EXHAUST PIPE, HEATER [25%]: "In way when erecting antenna."

TABLE 2.9(10) (U) MAINTAINER RATING & COMMENTS: TRAILBLAZER MAINTENANCE OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
054	2.8	QUICK-RELEASE PINS [50%]: "Retaining cables connecting pins are too fragile, & pins get lost."
031	2.7	TSU [25%]: Too many TSU failures because of problems with fuel lines & fuel filters.
063	2.5	MAST PNEUMATICS [50%]: (a) "Seals on mast can be easily damaged [from] impact on collars during extension & collapse. In some cases this has been known to cause antenna to missile." (b) "When power is lost, antenna drops."

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TABLE 2.9(11) (U) MAINTAINER RATINGS & COMMENTS: TRAILBLAZER MAINTENANCE INSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
069	3.5	EMERGENCY LIGHT [75%]: (a) "Lights burned out too easily." "Bulbs blow at blink of an eye!" (b) "Poor location."
089	3.5	BREAKER ACCESS PANEL DOOR [100%]: (a) "Too many screws; door pops out when last screw released." Needs clamp or velcro instead. Screwdrivers easily lost & screws time consuming. (b) Top hinge preferred to side hinge.
073	3.2	OPERATOR CHAIRS [75%]: Chairs too large to perform certain functions without removing them; difficult to move [four bolts each; may take about five minutes to remove chair; should have quick release latches].
072	3.0	STORAGE SPACE within shelter [75%]: "Insufficient." Need storage space for "headsets, handsets, manuals, etc. during transportation."
075	3.0	WORK SPACE (for operations or maintenance procedures) [50%]: "Many jacks, screws, etc. are difficult to reach!"
076	3.0	INTERCOM CONTROLS [50%]: (a) "Bleed through of voice link onto other selections." (b) "Half of them aren't used."
091	3.0	DMU & HEAD DISK ASSEMBLIES [100%]: Unreliable. "Need some way to reprogram disk [on site]."
086	2.8	RECEIVER CONTROL & DISPLAY UNIT [50%]: (a) Not beneficial: "It seemed to have poor response to signal." Not a maintenance problem because was ignored by operators. (b) Needs keypad for entering frequencies.
088	2.8	POWER DISTRIBUTION BOX [50%]: (a) "Blocks door [to shelter] when working on it." (b) "Two of five elapsed time meters failed, which seems excessive for something with no wear or tear."
107	2.8	LABELING OF SYSTEM COMPONENTS [50%]: (a) "All cables on line replaceable units are hard to see because of their location, lack of space, & lack of lighting." (b) Operator panel not labelled "A45."
068	2.5	AIR CONDITIONER [75%]: (a) "Ineffective filters. Main vent opening has none." (b) "Runs out of freon often." (c) "A/C cover poorly designed; zipper breaks; doesn't need zipper anyhow. Pocket design collects water, which funnels through vents onto shelter floor; safety hazard. If pouch necessary, should have a drain hole." Cover attached with snaps, "which are much harder to manipulate than turnbuckles would be."
070	2.5	LIGHTING [50%]: [See also item 107.] Bulbs blow too frequently.
071	2.5	HEADROOM [50%]: Poor for taller operators.
085	2.5	SPEED OF THE COMPUTER from user's point of view [75%]: Slow. "Why Trailblazer logo?--wastes time."

TABLE 2.9(11) (U) MAINTAINER RATINGS & COMMENTS: TRAILBLAZER MAINTENANCE INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
109	2.5	EASE OF TRANSPORTING SYSTEM COMPONENTS [50%]: "RF processor is a pain to replace [while having to hang] off shelter."
082	2.0	AUDIO RECORDER [50%]: Not used.
108	n/a	FOR WHICH, IF ANY, SYSTEM CONTROLS OR PARTS IS ACCESSIBILITY FOR OPERATION OR MAINTENANCE NOT SATISFACTORY? (KNOBS, SWITCHES, CABLES, CONNECTORS, CIRCUITRY, ETC.) LIST. [100%] "Cables & connectors for signal processor & receiver enclosure units." "DF receiver & its cables & controls." "Cables on plasma, CPU, I/O chassis, RF processor, & others--lack of finger space." "RF cables, communications modem." "A45, which is not labeled but is the part around plasma scope."
110	n/a	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? IN NOT, WHY? [75%] (a) "[No], that's why you have a 10 manual." "[No], computer can more readily find that information through 'Help' command." (b) "Yes."
111	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? (CONTROLS, INDICATORS, LIGHTS, DESIGN, TIME CONSTRAINTS, OR ANY OTHER HUMAN FACTORS, TRAINING FACTORS, SAFETY FACTORS, LACK OF APPROPRIATE SUPPORT.) [75%] (a) "Operator manuals don't give proper power-up sequence for breakers. Suggest putting breakers in order of power-up to prevent writing over information on disk & causing failure. Or include proper sequence in manual." "Circuit breaker #31 needs [to be] a special switch to remind operators to turn it on last--[like] battleshort retaining bar. (b) "Improper initialization; i.e., in 'local' instead of 'auto' mode."
112	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF DEPLOYING THE TRAILBLAZER SYSTEM? [75%] (a) "Climbing on shelter to erect antenna." (b) Driving ground rod into rocky soil. (c) Operation mast transport retaining bar.
113	n/a	ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [75%] "Data link antenna elements break."
115	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF MAINTAINING THE TRAIL-BLAZER SYSTEM? [100%] (a) "Inaccessibility--very little work space for antenna without danger of falling." "No room." (b) "[Lack of] lighting." (c) "Replacing data link elements & re-tapping threads for elements." (d) "Antenna sags after repeated usage--as much as 18 inches!!!" (e) "Trying to work on a set while others are performing a mission."
117	n/a	WHAT SOFTWARE CHANGES WOULD YOU LIKE TO SEE? [75%] (a) "Quicker initialization program." (b) "Better BITE routine."

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2.9.4.2.1.2 (U) Maintainer interview findings. Table 2.9(12) organizes human factors finding obtained from maintainer interviews conducted by ARI. Interview findings that were essentially identical to those obtained with the Trailblazer MANPRINT Evaluation Questionnaire are not repeated, although gratuitous comments obtained with the questionnaire that did not belong to one of the questionnaire topic areas are included here. Significant editorial additions, comments, or changes are enclosed in brackets.

TABLE 2.9(12) (U) MAINTAINER INTERVIEW FINDINGS

No.	Topic: Gist of comments
01.	ANTENNA SYSTEM CABLES: Removing & replacing these cables is a "joke." To replace cable W2P2 on antenna that connects to magnetic field converter A3A8J1, must totally disassemble & unsolder one end of cable because cable is routed through a mechanically important channel that is too small for cable's jacks. "Talk about DOWN TIME!"
02.	RF PROCESSOR & POWER SUPPLY: (a) Having 20 screws on RF processor cover seems very excessive; very time-consuming. "It takes a full five minutes for two people to get cover off RF processor." (b) "Retaining screws on enclosure for RF processor & power supply (under shroud cover) are damaged by shroud cover--breaks them off, bends them, or other wise damages them. Causes difficulty in repairing processor; hinders access to inside components."
03.	ACCESSIBILITY: "Accessibility for removing & installing a lot of LRUs is quite limited--sometimes severely limited: e.g., replacing a cable on RF-524 J-box takes at least an hour & maybe as much as two hours or more. People get frustrated when there is not enough room. Accessibility to all of cables is a nightmare."
04.	TNC CO-AXIAL CABLES: "They could easily be misconnected because any TNC cable will connect to any TNC jack. It may not damage system, but it will cause it to be inoperable.

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2.9.4.2.2 (U) Maintenance Instructors' ratings and comments. Tables 2.9(13) and (14) summarize the maintenance-related findings obtained with the Trailblazer Questionnaire for Instructor Personnel for outside and inside the shelter, respectively. Three maintenance instructors completed the questionnaire. The presentation format follows that of Table 2.9(2).

TABLE 2.9(13) (U) INSTRUCTOR RATINGS & COMMENTS: TRAILBLAZER MAINTENANCE OUTSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
063	3.5	HOW GOOD IS THE CPE (COLLECTIVE PROTECTION EQUIPMENT) SUPPLIED WITH THE M1015A SHELTER? WHAT PROBLEMS, IF ANY, HAVE YOU EXPERIENCED OR DO YOU ANTICIPATE? [33%] "Worked with system two years; never worked properly yet. Too heavy & bulky, won't seal; zippers, hose, & electrical connections hard to get to. Support bracket broke with one of our people on platform."
062	2.7	HOW WELL SUITED IS THE M1015A VEHICLE TO THE TRAILBLAZER SYSTEM? [33%]: "Too slow; too many mechanical failures; too heavy."
030	n/a	VEHICLE LEVELING GAUGES [100%]: Gauges should be lower, so personnel do not have to climb on vehicle to read them.
031	n/a	TSU [100%]: Frequent maintenance. "Generator poorly maintained."
032	n/a	TOOLS for outside [100%]: Adequate when present, but set is not complete. Inventory control is needed.
033	n/a	GROUND ROD DRIVER [100%]: "Usually inoperable." "Dangerous." "Store in a room with CPE [see item 63]. Worthless!!!"
034	n/a	GROUNDING STRAPS/CABLES/CLAMPS [100%]: Spring-loaded, spool type of strap (like those used with aircraft) would be a time saver.
037	n/a	NOISE LEVELS [100%]: "Critical safety hazard"--ignored by many. "Too high"--especially 60 kW. "High for both generators."
039	n/a	POWER CABLE INSTALLATION [100%]: Too difficult for small soldiers. Time consuming, if all three team members were small.
041	n/a	HANDHOLDS for climbing onto shelter [100%]: "Not enough." "A few more would be nice, but this is not a problem."
042	n/a	EXHAUST PIPE, ENGINE [100%]: (a) With their protective screens, "little danger of getting burns." Need to be "clearly marked for safety." (b) Location competes with that for operating or maintaining mast systems.
044	n/a	WHIP ANTENNAS [100%]: (a) "Eventually somebody will get hurt from falling. (b) Need handhold to prevent RT-524 mount from being used instead.
045	n/a	MAST TRANSPORT RETAINING FASTENER [100%]: "Poorly designed." When deploying or stowing, weight of antenna makes retainer hard to operate.
049	n/a	CRANK HANDLE FOR DIPOLE ELEMENTS [100%]: (a) Internal damage if handle cranked too far. (b) Operator stands on cab [frame] to reach it.
051	n/a	DATA LINK ANTENNA ELEMENTS [75%]: "Fall out too easily."

TABLE 2.9(14) (U) INSTRUCTOR RATINGS & COMMENTS: TRAILBLAZER MAINTENANCE INSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
065	5.0	EMERGENCY LIGHT [100%]: Location is a safety hazard. "It should be on wall or forward bulkhead."
101	3.7	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? [0%]:
066	3.3	HEADROOM [33%]: This should have been considered "before deciding on this shelter."
080	3.3	RECEIVER CONTROL AND DISPLAY UNIT [100%]: (a) RCDU is an "adequate receiver," but SDU is "not an effective aid to operator." "Spectrum display unit is really useless for Trailblazer." "Very poor." "Too slow; rarely used." (b) "RCVR ADDRESS thumbwheels not used."
067	3.0	ADEQUACY OF STORAGE SPACE within shelter [33%]: "Adequate" for "manuals & other mission documents, but not for anything else."
079	3.0	SPEED OF THE COMPUTER from the operator's point of view [33%]: "Normally speed is ok, but there are times when it does slow you down."
068	2.7	OPERATOR CHAIRS [67%]: "Better if they could swivel."
069	2.7	ADEQUACY OF WRITING SURFACES [67%]: Field phone next to position 1 prevents writing shelf from being fully extended.
074	2.7	OPERATOR PANEL [33%]: "Caution panel should be lower & between operators so that they might observe a problem before master caution illuminates."
084	n/a	CAUTION PANELS [100%]: "Should be in a position where both operators could have an eye-level view of them. Maybe change places with ARC-164 receivers." "Ok," but exchange places with A28/30.
085	n/a	DMU & HEAD DISK ASSEMBLIES [100%]: Would be very reliable if power-up & power-off procedures were standardized. Maintenance would be greatly enhanced if reformat/copying procedures were available in field.
086	n/a	TSEC/KG-45 [100%]: "Loading KG-45 is one of worst functions operator encounters. It is up too high to get fill cable connected, & finger space is too limited. Maybe if it [were] a little lower, it would not be so awkward to connect fill cable." "Sometimes difficult to fill (load); very common problem for data link not [to be] able to function properly in field."
088	n/a	TSEC/KY-57 [100%]: "Same as with KG-45" [see item 086].
089	n/a	VOICE LINK TRANSCEIVER [100%]: "So unreliable, it should be replaced with a more modern transceiver."

TABLE 2.9(14) (U) INSTRUCTOR RATINGS & COMMENTS: TRAILBLAZER MAINTENANCE INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
100	n/a	WHAT PARTICULAR CONTROLS OR INDICATORS DO OPERATORS (OR MAINTAINERS) HAVE DIFFICULTY IDENTIFYING (BECAUSE OF LOCATION, LACK OF ADEQUATE LABELING, INFREQUENCY OF USE, ETC.)? [100]: (a) [Owing, presumably, to infrequency of use], "most of controls or indicators on SDU of RCDU; especially RCVR ADDRESS thumbwheels." (b) "A36-39 (intercom control, intercom set control); A-95 (in line amplifier; foldout 22, upper right corner)."
102	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? [100%]: Operator failure to use proper information & procedures.
105	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF EMPLOYING THE TRAILBLAZER SYSTEM? [100%]: (a) "[Lack of] proper planning & coordination seems to be one of most common problems. You have got to get [system] out on time with everybody on same page & frequency." (b) "Movement," because of particular track vehicle & weight it carries. (c) "Noise."
106	n/a	ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [100%]: (a) "Brakes on most of TSU's are in questionable condition. Some are unsafe." (b) "Hookups for lights are damaged to point where they don't fit at times." (c) "Pivot steering on many of the tracks is unreliable." (d) "Weight, track vehicle [itself], noise."
107	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF OPERATING THE TRAILBLAZER SYSTEM? [100%]: (a) "In many cases it is lack of support. As an example, on Fort Huachuca fielding, two sets assigned to maintenance had to leave doors open during training on set for almost two weeks because light bulbs needed to be replaced--(a ten minute job)." (b) "Weight, track vehicle [itself], noise" [same as item 106].
108	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF MAINTAINING THE TRAILBLAZER SYSTEM? [100%]: (a) "General support (air conditioner, generator, etc.)" (b) "Weight, track vehicle [itself], noise" [same as item 106].

2.9.4.1.7 (U) TDP data requirements--maintenance. This section applies the human factors maintenance data presented in the previous paragraphs and elsewhere to the specific maintenance questions posed in the TDP (TDP para 2.9.3.2).

2.9.4.1.7.1 (U) Access to system components (TDP DRs 2.9.3.2.1.1-2).

2.9.4.1.7.1.1 (U) Components requiring repair or replacement (DR 2.9.3.2.1.1). [Provided by test directorate.]

2.9.4.1.7.1.2 (U) Ease of access to system components (DR 2.9.3.2.1.2). The following problem areas were noted by the maintainers:

1. MOPP LEVEL IV: Installation/removal of cables with gloves. Difficult to service equipment atop carrier with lack of handholds.
2. WORKSPACE: In general, lacking. Cited as one of the most difficult aspects of system maintenance.
3. CABLES & CONNECTORS: Access generally cramped. Sometimes severely limited. Difficult routing for antenna cable W2P2.
4. RF PROCESSOR: (a) Difficult location--maintainer "hangs from shelter." (b) 10 minutes to remove cover (20 screws). (c) Access screws damaged by shroud cover.
5. OPERATOR CHAIRS: Require removal to get at nearby components.
6. SHELTER ACCESS: (a) Hindered when tailgate hinged on left & TSU connected. (b) Power distribution box door blocks access to shelter when open.
7. BREAKER ACCESS PANEL: Door locked with nine screws.

2.9.4.1.7.2 (U) Labeling and identification of circuitry and components (TDP DRs 2.9.3.2.2.1-4).

2.9.4.1.7.2.1 (U) "Were all circuits properly labeled?" (DR 2.9.3.2.2.1) No.

2.9.4.1.7.2.2 (U) "What circuits were not properly labeled?" (DR 2.9.3.2.2.2) (a) Maintainers cited many conflicts between manuals and the "real world." [See Training Issue, para 2.7: Table 2.9(5), item 029 & Table 2.9(9).] (b) Circuit breaker #31 needs label or identification as a special switch (to be turned on last).

2.9.4.1.7.2.3 (U) "Were all replaceable components identified?" (DR 2.9.3.2.2.3) No.

2.9.4.1.7.2.4 (U) "What replaceable components were not properly identified?" (DR 2.9.3.2.2.4) Operator panel not labeled "A45."

2.9.4.1.7.3 (U) Transportability of system components (TDP DRs 2.9.3.2.3.1-3).

2.9.4.1.7.3.1 (U) Ease of transport (DR 2.9.3.2.3.1). Many data link antenna elements are lost during transport. (b) TSU plagued by flat tires. (c) Mud gets deposited on TSU equipment and power connections during transport. (d) Miscellaneous items inside shelter (manuals, other documentation, headsets, personal items, etc.) have insufficient storage space and may be inadequately protected during movement.

2.9.4.1.7.3.2 (U) Weights and dimensions (DR 2.9.3.2.3.2). [Provided by test directorate.]

2.9.4.1.7.3.3 (U) "Who transported the component?" (DR 2.9.3.2.3.3) [Provided by test directorate.]

2.9.5 (U) Discussion.

2.9.5.1 (U) Human factors aspects of Trailblazer operations.

2.9.5.1.1 (U) TDP question 2.9.3.1.1: Is the AN/TSQ-138 and associated equipment easy to operate?

2.9.5.1.1.1 (U) The operators rated many components of the Trailblazer system on a five-point scale ranging from "very good" to "very poor," with "borderline" in the middle. One of the criteria they were asked to apply was "ease of use." Their overall mean rating of the components fell within the upper part of the "borderline" scale region. While this is not a "pure" measure of ease of use, it does reflect the general attitude of the operators toward the system, including ease of use. In fact, in the majority of instances in which a component or procedure was downrated, the most significant contributing factors mentioned by operators, either verbally or in writing, were related to ease of use. Factors that contributed to task difficulty varied from situation to situation: Some tasks were difficult physically (e.g., installing the power cable); a few were difficult because of environmental constraints (e.g., connecting the trailer support unit to the track at night in MOPP gear); a few were complicated (e.g., remembering the proper settings for a host of switches and controls); a few were uncomfortable (operating shelter temperatures that were too warm or too cool); etc.

2.9.5.1.1.2 (U) It should be noted that the ease of performing a particular task is sometimes independent of objective nature of the task. For example, several operators commented during the test that they really didn't know enough about computer software in general to be able to evaluate the Trailblazer software with which they were interacting. To those operators, the system software interface seemed perfectly alright; they reported the ease of operation to be high. To the other, more computer-literate operators, the software interface was inefficient and slow; it frustrated them, and they reported the ease of operation to be low. Hence, ease of operation is related to situational factors, among them the background experience and the expectations of the operator.

2.9.5.1.1.3 (U) Ease of operations must also be considered against performance criteria that the whole system (which includes the operators) should be able to meet. For example, it would be extremely desirable for operators to be able to arrive on site and set up the system in less than 20 minutes. The current test indicates that this particular objective cannot be realistically met with the current system. (Yet the operators find it very easy to accomplish some of the most time-consuming parts of the setup process--for example, raising and extending the mast with the switches in the mast control box: It is easy to raise and extend the mast, but it is impossible to accomplish the task in less time than the machine part of the system requires.) Likewise, the process of computer initialization is not difficult, but it is time consuming. And while no specific objective for initialization time has been specified, it would be desirable if the process could occur faster, time being a crucial factor in evaluating overall system performance. (Most of the time consumed by the initialization process is operator dependent; yet, while it is not difficult for operators to perform the required tasks if given ample time, as they were in the test, the difficulty would increase as the time interval were shortened.) Thus, higher system performance levels would decrease the ease of operating in instances where system performance is primarily operator dependent but would tend to be unrelated to ease of operating where system performance is primarily machine dependent. In both instances, however "ease of mission accomplishment" is the important variable; and the important

question is Are the crew's tasks sufficiently easy when the total system is functioning at a high level under realistic circumstances? Alternatively, Can the system be made to function at a high level under realistic circumstances with sufficient ease of operation?

2.9.5.1.2 (U) TDP question 2.9.3.1.2: Did operator discomfort result from the system operating temperature? Yes, discomfort within the shelter was one of the chief complaints of the operators. Although operator discomfort did not appear to have a significant effect on overall system performance, it was sometimes the occasion for mild personal conflict among crew members: Operator 1, who was near the air conditioning control and normally too warm, would tend to lower the temperature setting; which made Operator 2, to whom the control was out of reach and who was already too cold, colder.

2.9.5.1.3 (U) TDP question 2.9.3.1.3: Does the system minimize operator-induced failures? [Number and kind of system failures attributed to operators reported by test directorate.] ARI is unaware of any system failures attributed to operators. There was, however, considerable concern on the part of the operators that no one had determined for them the proper sequence for "powering up" the circuit breaker switches on the main power distribution panel. System "crashes" were sometimes attributed to improper start-up procedures.

2.9.5.2 (U) Human factors aspects of maintenance.

2.9.5.2.1 (U) TDP question 2.9.3.2.1: Can maintenance personnel readily gain access to circuitry power cables, connectors, and other essential system components to perform repair and replacement? The maintainers stated that access to mary system components was difficult, time consuming, and frustrating. Of special note were cables, connectors, and the RF processor.

2.9.5.2.2 (U) TDP question 2.9.3.2.2: Are circuity and replaceable components properly labeled or identified? The maintainers stated that the correspondence between their documentation and the actual labels was unreliable. They noted that many labels were hard to read because of the cramped spaces and lack of illumination.

2.9.5.2.3 (U) TDP question 2.9.3.2.3: Are system components easily transported? The maintainers cited no system components that were difficult to transport for maintenance purposes. They did cite instances in which normal transport or transit produced damage to or had ill effects upon equipment (data link antenna elements, TSU tires, TSU power connections, & miscellaneous unstored items in the shelter).

2.9.6 (U) Conclusion.

2.9.6.1 (U) Equipment access criterion. According to the maintainers, access to equipment was possible, but difficult and time consuming in most instances. Access for operations was adequate.

2.9.6.2 (U) Human factors standards criterion.

2.9.6.2.1 (U) From the operator's point of view some of the operational tasks were easy to accomplish and some were difficult, as would be expected. With the several exceptions noted in this report, the physical and mental

acts involved in performing many of the Trailblazer operational tasks are, once learned and practiced, easy enough. The difficult tasks, while fewer in number, tended to be of greater import than the relatively easy ones. The data indicate, however, that the operators viewed the system as a whole as "borderline" with respect to ease of operating. However, this assessment does not consider the possible effects on ease of use in a more rigorous tactical environment, which might include: frequent, hectic movement; bad weather conditions; greatly increased operator stress and fatigue; less adequate maintenance; etc. The conditions under which the operators functioned during the IOTE were characterized by infrequent and relaxed movement, excellent weather (although extremely warm, outside the shelter, during parts of the test), very low operator stress and fatigue (other than that reportedly caused by boredom), and prompt maintenance attention.

2.9.6.2.2 (U) The operators experienced significant discomfort from the system operating temperature.

2.9.6.2.3 (U) The system minimizes operator-induced system failures in a benign environment. In the same environment, the system contributes in some ways to operator errors and increased performance times. The latter effect would be expected to increase operator-induced system failures on the battlefield, but to what extent is undetermined.

2.9.6.2.4 (U) The system partially complies with human factors engineering principles. There were significant exceptions.

APPENDIX A

This appendix contains:

1. Copy of Fort Devens Training Evaluation Report
2. Copy of Fort Devens Maintenance Evaluation Report

Note: Copies of these reports that were provided to the test team had been made by copying machine and are of poor quality. Several pages are essentially illegible. Attempts to secure the original reports or better copies of the reports were unsuccessful. This, however, does not affect the recommendations and conclusions presented in either the Fort Devens reports or this report.

Training Evaluation Report

ATSI-ETD-NT

23 May 1989

MEMORANDUM FOR RECORD

SUBJECT: TRAILBLAZER Operator Class # 1

1. Operator training class # 1 was successfully conducted during the period 24 April to 5 May 1989.

2. Training was conducted in accordance with the Training Test Support Package and Training Certification Plan.

3. All students were trained to standard and were able to perform all tasks related to the operation of the AN/TSQ-138 Master Control Set.

4. Students were not trained to standard on the operation, set-up and tear down of the Collective Protection Equipment (CPE). Students were familiarized on the equipment. The CPE equipment on all shelters were non operational. Protective entrance door seals did not fit. During set-up of one CPE platform one of the platform support brackets broke loose of the shelter causing the platform to fall. CPE equipment does not appear to be safe. The CPE should be removed from the AN/TSQ-138 until it has been designed and built for safe operation.

Richard J. Richwine
SFC/E7
Training Evaluator

ATSI-ETD-NT 23 May 1989

MEMORANDUM FOR RECORD

SUBJECT: TRAILBLAZER Operator Class # 2

1. Operator training class # 2 was successfully conducted during the period 8 to 19 May 1989.

2. Training was conducted in accordance with the Training Test Support Package and Training Certification Plan.

3. All students were trained to standard and were able to perform all tasks related to the operation of the AN/TSQ-138 Master Control Set.

4. Students were not trained to standard on the operation, set-up and tear down of the Collective Protection Equipment (CPE). Students were familiarized on the equipment. The CPE equipment on all shelters were non operational. Protective entrance door seals did not fit. During set-up of one CPE the platform support beam bracket broke. The support beam is used to lift and lower the CPE platform from the stowed position. The CPE equipment does not appear to be safe. The CPE should be removed from the AN/TSQ-138 until it has been designed and built for safe operation.

Richard J. Richwine
SFC/E7
Training Evaluator

ATSI-ETD-NT 22 June 1989

MEMORANDUM FOR RECORD

SUBJECT: TRAILBLAZER Operator Training Evaluation

1. Background: Trailblazer operator training was conducted during the period of 24 Apr through 26 May 1989 at Ft Huachuca Az. Training was divided into two separate classes of nine operator personnel per class. Both operator classes were two weeks in length with a combined practical exercise at the end of the second week of training. Operator training was conducted by the New Equipment Training Team. Development of training materials and conduct of training was contracted for by the material developer. The operator training course has been successfully used in fielding of the Trailblazer system to six separate commands. This iteration of training was in support of the Trailblazer Initial Operational Test and Evaluation scheduled for 5 June through 28 July 1989.

2. Scope of Training: The Trailblazer operator training course is designed to instruct operators in MOS 98G in deployment, set-up, tear down, preventive maintenance checks and services (PMCS), and operation of the AN/TSQ-138 Master Control Set (MCS). The training course does not instruct operators in common soldier skills of land navigation, sending radio messages, camouflage of equipment and nuclear, biological, and chemical operations. Personnel attending training are required to possess a licence to operate the M1015 tracked vehicle and the MEP-114A 30kw generator set. The training course briefly touched on the PMCS and operation of this equipment. Students will not be trained to standard on the M1015 track vehicle or MEP-114A 30kw generator.

3. Conduct of Training:

a. Method: Operator training was conducted in two classes. There were eight students in the first training class and there were nine students in the second class. Each class was broken down into three groups of three students with one instructor per group. The small groups were used for 90% of the instruction. While in small groups instructors used a combination of simultaneous conference/demonstration followed by practical exercise. Lecture/conference was used for about 10% of the instruction. When lecture/conference method was used all the small groups were combined into one large group. The small group method of training appeared to be more effective than the large group. Operators were trained in individual actions necessary to set-up and operate the MCS. Operators were not trained to perform effectively as a crew.

b. Observations class Number 1:

(1) Personnel: There were eight operators MOS 98G which attended the first training session. Operators were of the correct target audience. Not all operators possessed the perquisite skills required for the course and test. Of the eight operators six were licenced on the M1015 track vehicle. Five of these operators had been recently licenced and had little experience with the M1015 vehicle. Two operators had no experience with the M1015. None of the operators had experience with the MEP-114A 30kw generator.

(2) Instructors: There were four civilian instructors assigned to the new equipment training team. Instructors appeared to be knowledgeable and qualified to instruct students on the Trailblazer system. Instructors were professional in their behavior. Training problems did arise as result of the actions and conduct of one of the instructors. (see student critiques). When monitored. the instructor's conduct and actions appeared to be acceptable. However, this instructor was removed from the instruction team. His actions had a negative effect on training. Overall the instruction team did a good job.

(3) Equipment: The overall condition of the equipment used during training was poor but usable. The majority of the problems were with the M1015 track and the MEP-114A 30kw generator. At first, there was no maintenance support available for the M1015 track or the 30kw generator. There was maintenance support for the system electronics. Training time was lost waiting for petroleum oils and lubricants (POL) to be brought to the training site. Instructors did a good job of working around equipment problems during training.

(4) Instruction/Training Problems: Operator training consisted of 22 separate lesson plans. Through out the course the instructors did not effectively explain the objectives of each lesson.

(a) The course started with an introduction to Trailblazer lesson which did not give much information about the system. This lesson did not go into enough depth about the description, capabilities and mission of the Trailblazer system. Without this additional information operators were unsure as to what Trailblazer was and what it could do.

(b) The next four lessons numbers two through six were on PMCS, parking and leveling, grounding, operation of the 30 and 60kw generators and on deploying/stowing of the antenna group. This group of lessons were difficult to follow because of the instruction method used. These lessons were given to the group as a whole starting off with a short lecture about each subject. A practical exercise was not done until all five lessons had been covered during lecture. Jumping from subject to subject without PE was confusing.

(c) Lessons 7 through 10 were instructed with no problems noted.

(d) Lesson number 11 was on set and system bite tests. The instruction did teach students how to run the bite tests but was lacking in operator corrective actions to bite failures. These corrective actions are not listed in the operator technical manual. There are some bite failures which can be corrected by recycling power. If recycling the power does not work then call maintenance.

(e) Lessons 12 through 16 were complete and instructed with no problems noted.

(f) Lessons 17 and 18 were on mission tasking and reporting. The lesson on mission tasking and reporting were conducted as a large group lecture/conference. The mission tasking lesson was confined to lecture/conference without a good practical exercise. This was caused by the lack of a Technical Control and Analysis Center (TCAC) available for reporting link communications. With out the TCAC students can be told how it works but cannot physically perform the function. The practical exercise was limited to looking at empty incoming message directories. The mission reporting lesson was slightly better than the mission tasking. This lesson was still limited by the reporting data link not being active. Operators were able to cover all the procedures necessary to perform the reporting function up to sending the message to the TCAC. This lesson did not cover all message formats contained within the MCS software. It did cover the two most important messages for product reporting. This lesson should cover all messages generated by the system.

(g) Lessons 19 through 21 were instructed with no problems noted.

(h) Lesson 22 was on the Collective Protection Equipment (CPE). Although lesson materials are complete, students were not trained to standard on the operation, set-up and tear down of the CPE due to equipment problems. Students were familiarized on the equipment. The CPE equipment on all shelters were non operational. Protective entrance door seals did not fit. During set-up of one CPE platform one of the platform support brackets broke loose of the shelter causing the platform to fall. The CPE does not appear to be safe. The CPE should be removed from the AN/TSQ-138 until it has been designed and built for safe operation.

(i) Students were trained to standard on all tasks associated with the MCS. Students were not trained to standard on CPE operations.

c. Observations Class Number 2:

(1) Personnel: There were nine operators MOS 98G which attended the second training session. Operators were of the correct target audience. Operators did not possessed the perquisite skills required for the course and test. None of the operators were licenced on the M1015 track vehicle. None of the operators had experience with the MEP-114A 30kw generator.

(2) Instructors: There were four civilian instructors assigned to the new equipment training team. Instructors appeared to be knowledgeable and qualified to instruct students on the Trailblazer system. Instructors were professional in their behavior. One instructor was replace as result of the first training class. No problems were noted with the instructors during this training session. Overall the instruction team did a good job.

(3) Equipment: The overall condition of the equipment used during the second class was better than the first. There were problems with the M1015 track and the MEP-114A 30kw generator. Maintenance support was available for the M1015 track and the 30kw generator during this session. Maintenance support for the system electronics was available. POL was available at the training site. Instructors did a good job of working around equipment problems as they occurred. No training time was lost as a result of equipment problems.

(4) Instruction/Training Problems: Operator training consisted of 22 separate lesson plans. Through out the course the instructors did not effectively explain the objectives of each lesson.

(a) The course introduction was not changed. Comments from the first class session still apply.

(b) The next four lessons numbers two through six were on PMCS, parking and leveling, grounding, operation of the 30 and 60kw generators and on deploying/stowing of the antenna group. Following recommendations from students and training evaluator these lessons were taught at the equipment using lecture demonstration. Following the lecture demonstration students were broken down into groups for the PE. This method appeared to work better than the method used for the first class.

(c) Lessons 7 through 10 were instructed with no problems noted.

(d) Lesson number 11 on set and system bite tests was not changed form the first class session. Comments from the first class session still apply.

(e) Lessons 12 through 16 were complete and instructed with no problems noted.

(f) Lessons 17 and 18 were on mission tasking and reporting. These lessons were not changed from the first class session. Comments from the first class session still apply.

(g) Lessons 19 through 21 were instructed with no problems noted.

(h) Lesson 22 was on the collective protection equipment. Although lesson materials are complete students were not trained to standard on the operation, set-up and tear down of the Collective Protection Equipment (CPE) due to equipment problems. Students were familiarized on the equipment. The CPE equipment on all shelters were non operational.

Protective entrance door seals did not fit. During set-up of one CPE the platform support beam bracket broke. The support beam is used to lift and lower the CPE platform from the stowed position.

(i) There were no new and unusual training problems experienced by the second class. Students were trained to standard on all tasks associated with the MCS. Students were not trained to standard on CPE operations.

d. Operator Testing: All operators were given a hands on performance examination as well as a written final. During the hands on examination operators were tested by one instructor and witnessed by the training evaluator. Testing operators in this manner allowed the training evaluator to ensure all operators could perform the tasks. Operators were tested on all tasks individually not as a member of a crew. Operators which were trained during the first class showed an across the board weakness in the set-up of the data and reporting link communication equipment. Operators of the second class did not show any across the board weakness which could indicate a training problem. Because of the problems experienced with the CPE no operator testing was done.

e. Observations Combined Practical Exercise: Following the completion of the second session of training students were divided up into five crews. Three of the crews were deployed on a daily basis to the east range of Ft Huachuca. Crews were given mission tasking and a signal environment was provided by the INSBD. This was the first time students were able to work as crews during a deployment. It was apparent that operators could function as a crews and their individual skills were acceptable. Crews were lacking in experience with the equipment for set-up and tear down. Crews were not effective during the first few days. Once the crews began to work together set-up and tear down seemed to flow a little better. The ineffectiveness of the crews can be attributed to the lack of crew training during the class sessions. As this was the first PE that students worked with out instructors in the shelters with them it went well and was valuable training.

4. Training Materials: The training materials used by the new equipment training team were complete and for the most part accurate. Problem areas included a correct power-up/down procedure, and operation of the Sony tape recorder. There were differences in the power up/ down procedure between the operator technical manual and the lesson materials. There were no procedures for the Sony tape recorder in the technical manual. Students were given student work books and operator guides. The lesson plans were in outline form. This form heavily relies on instructor knowledge for class presentation. The lesson plans could easily be used for unit sustainment training purposes. The operator guides given to students were an excellent working aid. The operator guide fits into the cargo pocket of the battle dress uniform which makes it easily available for operators. The operator guide should not be used as a replacement for the operator technical manual provided with the system.

5. Observations During Test: There were no operational problems or failures experienced during 5 thru 22 June which could be attributed to the operator training. Operators were able to perform there mission during this portion of the test.

6. Recommendations: Revise lesson plan number 1 to include more information about the Trailblazer system. Add an additional lesson on Trailblazer/Quickfix interoperability When instruction is given on the mission tasking and reporting, a TCAC should be available to exercise the reporting data link. Incorporate crew training into the instruction i.e. during set-up and tear down have students perform as if they were a crew each with individual responsibilities. Finally remove the CPE from the Trailblazer system. It appears to be unsafe, inoperable and of poor design.

7. Conclusion: Operators at the completion of training were trained to standard and able to perform all tasks required during the IOTE. Training materials are acceptable. Training was conducted in accordance with the Training Test Support Package and Training Certification Plan.

8. Personal Data Sheets: Operator personal data sheets are at enclosure 1.

9. Student Critiques: Students course critiques are at enclosure 2.

10. Operator test results are at enclosure 3.

11. Lesson plans, and POI are at encl 4.

12. Point of contact for this memorandum is SFC Richard J. Richwine AV 256-2760.

encl 4

Richard J. Richwine
SFC, USA
Training Evaluator

TRAINING REFERENCES (OPERATOR)

ITEM	ITEM TYPE	PROVIDED BY	DATED	REMARKS
Operator's Manual	TM 32-5811-702-10	Cdr. US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P Fort Hill Farms Station, Warrenton, VA 22186-5141	Aug 88	Used as needed.
Training Materials	Training Materials from USAFSC	Potomac Research Incorporated 5121 Licolnia Road, Alexandria VA. 22312	Mar 89	Used as formal training at Fort Huachuca, Arizona Prior to testing.
Student Handouts	Operator Guide and Student Workbook	Potomac Research Incorporated 5121 Licolnia Road, Alexandria VA. 22312	Mar 89	

2.7.3 (U) Method

(U) The test directorate included training evaluators, who assessed the effectiveness of the training for operators, supervisors, and maintenance personnel. Operators, supervisors, and maintenance personnel completed questionnaires regarding the training's thoroughness in explanation of equipment description, user operation and maintenance. Training was evaluated using questionnaires, observations of actual mission performance and monitoring of instruction by training evaluators. Handouts were assessed as to their completeness, accuracy, and comprehensiveness. Data were collected through interviews, questionnaires and comments.

2.7.4 (U) Results

2.7.4.1 (U) All tasks were trained to acceptable standards for operators, maintainers, and supervisors. Training materials assumed that the operators and maintainers had previous institutional or on the job training with the M1015 track and 30kw generator. However, this was not the case. As a result of this, instructors and test directorate personnel were required to teach preventive maintenance checks and service as well as operation of the M1015 track and 30kw generator.

2.7.4.2 (U) TMs in final form were utilized during training. Both operator and maintenance TMs were validated and verified. Although the TMs had been verified there were still minor errors found in the power up/down procedures and use of the Sony cassette recorder. Player and evaluator comments indicate that the training was adequate and for the most part easily understood. There were cases where operator training was difficult to understand. This was due to the civilian instructors not having experience in the job of the 98G.

2.7.4.3 (U) Training evaluator's comments are at appendix ____

2.7.5 (U) Analysis

2.7.5.1 (U) Following training, the operators, supervisors, and maintainers performed all tasks necessary to operate and maintain the AN/TSQ-138 The criterion was met.

2.7.5.2 (U) Player personnel comments from training questionnaires indicate that the shortcomings in the TMs were minor. The training provided was adequate to sustain operation and maintenance of the AN/TSQ-138. The criterion for training materials was met.

.7 ISSUE 7. TRAINING

uestion 2.7.3.1.

R 2.7.3.1.1.1 MOS 98G Skill levels 1 thru 4.

R 2.7.3.1.1.2 thru 2.7.3.1.1.10

AME	MOS	RANK	TIMOS	TIS	CIV ED	MIL ED	DUTY ASSIGN	EXP	HWSADH
LANCHARD	98G40	SFC	84M	15Y5M	BA	ANCOC	TRAINING DEVELOPER	NONE	74/200/M/46/R
[redacted]	98G30	SSG	52M	8Y6M	AA	ANCOC	TRAINING DEVELOPER	NONE	74/170/M/28/L
[redacted]	98G30	SSG	52M	5Y9M	50HR COLL	BNCOC	ECM SOD LDR	NONE	71/181/M/29/R
RRANT	98G30	SSG	89M	8Y5M	AA	BNCOC	VOICE COLL	NONE	70/174/M/27/R
[redacted]	98G30	SSG	108M	10Y8M	3Y COLL	BNCOC	TBL INSTRUCTOR USAISD		66/145/F/29/R
EAMAN	98G30	SSG	72M	11Y6M	1Y COLL	BNCOC	TBL INSTRUCTOR USAISD		68/158/M/29/R
NDERSEN	98G20	SGT	36M	5Y	BS	PLDC	OPERATOR TSC (CEWI)	NONE	72/180/M/37/R
OWIE	98G20	SGT	24M	3Y11M	HS	BASIC SCHOOL	OPERATOR 109TH MI	NONE	71/171/M/ /L
HARO	98G20	SGT	5M	1Y	AS	BASIC SCHOOL	OPERATOR TSC (CEWI)	NONE	71/175/M/24/R
[redacted]	98G20	SGT	84M	8Y6M	HS	BNCOC	OPERATOR 109TH MI	NONE	72/185/M/31/R
ENGER	98G20	SGT	15M	3Y1M	1.5Y COLL	BASIC SCHOOL	OPERATOR 107TH MI	1Y B(V)1	72/180/M/23/R
ARTER	98G10	SPC	46M	9Y5M	1.5Y COLL	PLDC	OPERATOR 109TH MI	NONE	69/156/M/30/L
OBERTS	98G10	SPC	12M	3Y	3Y COLL	BASIC SCHOOL	OPERATOR 109TH MI	NONE	68/180/F/28/R
HEARER	98G10	SPC	3M	1Y8M	HS	BASIC SCHOOL	OPERATOR TSC (CEWI)	NONE	62/125/F/19/R
UMMERS, J.	98G10	SPC	12M	2Y9M	1SEM COLL	BASIC SCHOOL	OPERATOR 107TH MI	NONE	71/207/M/23/R
UMMERS, L.	98G10	SPC	24M	3Y8M	1SEM COLL	BASIC SCHOOL	OPERATOR 107TH MI	NONE	64/120/D/22/R
UIONTEK	98G10	SPC	4M	1Y8M	HS	BASIC SCHOOL	OPERATOR TSC (CEWI)	NONE	62/114/F/19/R

Mos 33T Skill level 1-4

.1.2.2 thru 2.7.3.1.2.10

ME	MOS	RANK	TIMOS	TIS	CIV ED	MIL ED	DUTY ASSIGN	EXP	HWSADH
	33T40	SFC	M50M	12Y6M	HS	ANCOC	TRAINING DEVELOPER	NONE	72/200/M/32/R
N	33T30	SSG	'72M	7Y3M	HS	BNCOC	INSTRUCTOR USAISD	NONE	71/175/M/29/R
	33T10	SPC	6M	5Y9M	HS	BASIC	REPAIRMAN	NONE	68/160/M/23/R
	33T10	SPC	16M	2Y4M	AA	SCHOOL PLDC	105TH MI REPAIRMAN TSC (CEWI)	NONE	66/138/F/30/R

7.3.2 YES

3.2.1 YES

Tasks for employment.

e Ground Rod Driver.

ator preventive maintenance checks and services on the master

or preventive maintenance checks and services on the

ler support unit for operations. (30 Kw Generator

control set for power-on

control set.

ntenna group.

F/28/R

ntrol set.

trained.

operator comments)

ing is required.

Question 2.7.3.2.2 Yes.

DR 2.7.3.2.2.1 The following tasks are required to operate the system.

1. Initialize the master control set.
2. Communications equipment set-up (voice, data and reporting links)
3. Initiate a directed search
4. Initiate a general search
5. Update directed and general search plans from a tasking message.
6. Intercept signals.
7. Edit fix and lob displays
8. Create a gist file.
9. Produce an outgoing message.

DR 2.7.3.2.2.2 All tasks were trained.

DR 2.7.3.2.2.3 None

DR 2.7.3.2.2.4 [redacted]

DR 2.7.3.2.2.5 [redacted]

Question 2.7.3.2.3 Yes

DR 2.7.3.2.3.1 The following tasks are required to maintain the system.

1. Perform preventive maintenance checks and services on the master control set. (Organizational)
2. Determine the operational status of the master control set. (Organizational)
3. Troubleshoot the master control set. (Organizational)
4. Troubleshoot the interconnecting box in the master control set. (DS/GS)
5. Troubleshoot the analog to digital converter in the master control set. (DS/GS)
6. Troubleshoot the communications modem in the master control set. (DS/GS)
7. Troubleshoot the signal processer in the master control set. (DS/GS)

DR 2.7.3.2.3.2 All tasks were trained.

)R 2.7.3.2.3.3 None

)R 2.7.3.2.3.4 See student critiques for comments.

)R 2.7.3.2.3.5 No additional training is necessary.

)uestion 2.7.3.2.4 YES

)R 2.7.3.2.4.1 Yes

)R 2.7.3.2.4.2 YES

)R 2.7.3.2.4.3 Yes/No see student course critiques.

)uestion 2.7.3.2.5 Yes

)R 2.7.3.2.5.1 Yes

)R 2.7.3.2.5.2 See student course critiques and training evaluator MFR.

)R 2.7.3.2.5.3 Yes

)R 2.7.3.2.5.4 See student course critiques and training evaluator MFR.

)uestion 2.7.3.2.6 Operators were able to perform all critical tasks.

)R 2.7.3.2.6.1

1. Operate the Ground Rod Driver.

2. Perform operator preventive maintenance checks and services on the master ontrol Set

3. Perform operator preventive maintenance checks and services on the railer support unit.

control

4. Prepare the trailer support unit for operations. (30 Kw Generator peration)

5. Prepare the master control set for power-on

6. Power-on the master control set.

7. Deploy and stow the antenna group.

8. Power off the master control set.

9. Initialize the master control set.

10. Communications equipment set-up (voice, data and reporting links)

11. Initiate a directed search

12. Initiate a general search

13. Update directed and general search plans from a tasking message.

14. Intercept signals.

15. Edit fix and lob displays

16. Create a gist file.

17. Produce an outgoing message.

DR 2.7.3.2.6.2 Operators were able to perform all tasks.

DR 2.7.3.2.6.3 NA

DR 2.7.3.2.6.4 NA

Question 2.7.3.2.7 Maintainers were able to perform all maintnenance tasks.

DR 2.7.3.2.7.1

1. Perform preventive maintenance checks and services on the master control set. (Organizational)

2. Determine the operational status of the master control set. (Organizational)

3. Troubleshoot the master control set. (Organizational)

4. Troubleshoot the interconnecting box in the master control set. (DS/GS)

5. Troubleshoot the analog to digital converter in the master control set. (DS/GS)

6. Troubleshoot the communications modem in the master control set. (DS/GS)

7. Troubleshoot the signal processer in the master control set. (DS/GS)

DR 2.7.3.2.7.2 All tasks were performed by maintenance personnel

DR 2.7.3.2.7.3 NA

DR 2.7.3.2.7.4 NA

DR 2.7.3.2.8 Operators and maintainers were able to perform 100 percent of the tasks required.

DR 2.7.3.2.8.1

1. Operate the Ground Rod Driver.

2. Perform operator preventive maintenance checks and services on the master Control Set

3. Perform operator preventive maintenance checks and services on the trailer support unit.

4. Prepare the trailer support unit for operations. (30 Kw Generator Operation)

5. Prepare the master control set for power-on

6. Power-on the master control set.

7. Deploy and stow the antenna group.

8. Power off the master control set.

9. Initialize the master control set.

10. Communications equipment set-up (voice, data and reporting links)

11. Initiate a directed search

12. Initiate a general search

13. Update directed and general search plans from a tasking message.

14. Intercept signals.

15. Edit fix and lob displays

16. Create a gist file.

17. Produce an outgoing message.

DR 2.7.3.2.8.2 All

DR 2.7.3.2.8.3 None

DR 2.7.3.2.8.4 NA

DR 2.7.3.2.8.5

1. Perform preventive maintenance checks and services on the master control set. (Organizational)

2. Determine the operational status of the master control set. (Organizational)

3. Troubleshoot the master control set. (Organizational)

4. Troubleshoot the interconnecting box in the master control set. (DS/GS)

5. Troubleshoot the analog to digital converter in the master control set. (DS/GS)

Troubleshoot the communications modem in the master control set. (DS/GS)

7. Troubleshoot the signal processer in the master control set. (DS/GS)

DR 2.7.3.2.8.6 All

DR 2.7.3.2.8.6 None

DR 2.7.3.2.8.7 NA

Maintenance Evaluation Report

ATSI-ETD-NT

23 May 1989

MEMORANDUM FOR RECORD

SUBJECT: TRAILBLAZER Unit Level Maintenance Training

1. Unit level maintenance training was successfully conducted during the period 24 April to 10 May 1989.

2. Training was conducted in accordance with the Training Test Support Package and Training Certification Plan.

3. All students were trained to standard and were able to perform all tasks related to unit level maintenance of the AN/TSQ-138 Master Control Set.

George E. Koebler
SFC/E7
Training Evaluator

ATSI-ETD-NT

23 May 1989

MEMORANDUM FOR RECORD

SUBJECT: TRAILBLAZER Direct and General Support Maintenance Training.

1. Direct and General Support maintenace training was successfully conducted during the period 11 to 22 May 1989.

2. Training was conducted in accordance with the Training Test Support Package and Training Certification Plan.

3. All students were trained to standard and were able to perform all tasks related Direct and General support maintenance for the AN/TSQ-138 Master Control Set.

George E Koebler

George E. Koebler
SFC/E7
Training Evaluator

ATSI-ETD-NT 22 June 1989

MEMORANDUM FOR RECORD

SUBJECT: TRAILBLAZER Maintenance Training Evaluation

1. Background: Trailblazer Maintenance training was conducted during the period of 24 Apr thru 22 May 1989 at Ft Huachuca Az. Maintenance training was divided into two separate courses. Organizational level training was conducted from 24 Apr thru 9 May 1989. Direct and General support training was conducted from 10 May to 22 May 1989. Maintenance training was conducted by the New Equipment Training Team (NETT). Development of training materials and conduct of training was contracted, by the material developer. The maintenance training courses have been successfully used in fielding of the Trailblazer system to 6 separate commands. This iteration of training was in support of the Trailblazer Initial Operational Test and Evaluation scheduled for 5 June thru 28 July 1989.

2. Scope of Training: The Trailblazer organizational level maintenance course is designed to instruct maintainers in MOS 33T, in preventive maintenance checks and services (PMCS), operation of the AN/TSQ-138 Master Control Set, and system troubleshooting; to the Line Replaceable Unit (LRU) (black box) and associated cabling. The Direct Support/General Support (DS/GS) level maintenance course is designed to instruct the maintainer, to troubleshoot the LRU to the Circuit Card Assembly (CCA) using Test Interface Devices (TIDE) and some electrical alignment. The training courses does not instruct maintainers, in maintaining and repair of Government Furnished Equipment (GFE), ie tracks (M1015), 30kw generators and communications equipment.

3. Conduct of Training:

a. Method: Training was conducted using conference/demonstration followed by practical exercise (PE). Conference/demonstration was used for about 20% of the instruction, with more time being shifted into PE. During PE, the class was split up, into two teams, of three each. With more time being shifted into PEs, the maintainers were able to troubleshoot more faults. There by becoming more familiar with the system.

b. Observations, Organizational Maintenance Course:

(1) Personnel: There were six maintainer in MOS 33T. Maintainers were of the correct target audience, possessing the perquisite skills required for the course and test.

(2) Instructors: There were two civilian instructors assigned to the NETT. One of the instructors was more qualified to be an operator instructor, than a maintenance instructor. In fairness to him most of his platform time was in the operating functions of the AN/TSQ-138. However, problems arose during the PEs, due to his being unfamiliar with maintenance techniques. Both, instructors could have used a course in instructional techniques. Neither, was a very good platform

instructor, both mumbled, read directly from instructional notes and had very poor platform mannerisms; i.e. talked to slides, poor questioning technique (when they did ask questions) and leaning on the podium. Instructors did present the training material and the students had no trouble comprehending, what was presented, therefore, I would say the training was successful. Instructors were professional in their behavior. Overall the instruction team did a fair job.

(3) Equipment: The overall condition of the equipment used during training was poor, but usable. The majority of the problems were with the M1015 track and the MEP-114A 30kw generator. During the first few days, there was no maintenance support available for the M1015 tracks or the 30kw generators. There was maintenance support for the system electronics. Training time was lost waiting for petroleum oils and lubricants (POL) to be brought to the training site. Instructors did a good job of working around equipment problems during training.

(4) Instruction/Training Problems: Maintenance training consisted of 22 separate lesson plans (lps) followed by a quiz for each lp. Through out the course, the instructors did not give the Behavior, Condition and Standards (BCS) nor did they recapitulate, reemphasize or issue a closing statement. This was one of the reasons that the every conference/demonstration lp, ran one fourth, to one half the scheduled time. This did allow for more time to be used during PEs.

(a) Students were trained to standard on all tasks associated with the MCS.

(b) Students were not trained on the Collective Protection Equipment (CPE).

c. Observations DS/GS Maintenance Course

(1) Personnel: Same students that attended organizational level course.

(2) Instructors: Same as organizational level course.

(3) Equipment: Instructors did a good job of working around equipment problems as they occurred. No training time was lost as a result of equipment problems.

(4) Instruction/Training Problems: Same comments that were noted during organizational level maintenance course also apply to DS/GS maintenance course.

(a) There were no new and unusual training problems experienced during this course. Students were trained to standard on all tasks associated with DS/GS maintenance of the MCS.

d. Maintenance Testing: There were 19 separate lps with quizzes after 13 of the lps. All maintainers were tested through out the course via hands on performance examination. During the hands on examination maintainers were tested by both instructor and witnessed by the training evaluator. Testing in this manner allowed the training evaluator to ensure all, could perform the tasks.

e. Observations Combined Practical Exercise: Following the completion of all training. Operators were divided up into five crews. Three of the crews were deployed on a daily basis to the east range of Ft Huachuca. Crews were given mission tasking and a signal environment was provided by the INSBD. Maintenance support was provided by the newly trained 33T. This was the first time the students worked without the instructors. It went well and was valuable training. The maintainers were able to handle all trouble calls without any difficulties. Their individual skills were acceptable and they worked well as a team.

4. Training Materials: The training materials used by the NETT, were complete and for the most part accurate. Students were given student work books and a technical manual. The lesson plans were in outline form with brief explanation. This form heavily relies on instructor knowledge for class presentation. The lesson plans could easily be used for unit sustainment training purposes.

5. Observations During IOTE: There were no maintenance failures experienced during 5 thru 22 June, which could be attributed to the maintenance training. Maintainers were able to perform their mission during this portion of the test.

6.
Recommendations:

a. Delete the following operator functions from the Program of Instruction (POI).

(1) Unit 3.1 Establish Operational Site

(2) Unit 4.1 Principles of Direction Finding

(3) Unit 4.2 Principles of Search Operation

(4) Unit 4.3 Principles of Intercept Operation

(5) Unit 4.4 Principles of Communication Operation

(6) Unit 5.1 Perform Intercept Operations

(7) Unit 5.2 Perform Automatic Search Operation

(8) Unit 5.3 Perform Direction Finding Operation

(9) Unit 5.4 Operate Text Message System

(10) Unit 5.5 Operate Under Usual Conditions

(11) Unit 7.2.2 Analyze Error Messages

(12) Consolidate some of the quizzes and make them more difficult.

b. Add an additional lesson plan on alignment of the DF antenna couplers .

7. Conclusion: Maintainers at the completion of training were trained to standard and able to perform all tasks required during the IOTE. Training materials are acceptable. Training was conducted in accordance with the Training Test Support Package and Training Certification Plan.

9. Personal Data Sheets: Maintainers personal data sheets are at enclosure 1.

10. Student Critiques: Students course critiques are at enclosure 2.

11. POC: SFC George E. Koebler AV 256-2760

encl 2

George E. Koebler
SFC/USA
Training Evaluator

TRAINING REFERENCES (MAINTAINER)

ITEM	ITEM TYPE	PROVIDED BY	DATED	REMARKS
Operator's Manual	TM 32-5811-902-10	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P, Vint Hill Farms Station, Warrenton, VA, 22186-5141	Aug 88	Used as needed.
Maintenance and Parts Manual (SYSTEM)	TM 32-5811-902-20&P	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P, Vint Hill Farms Station, Warrenton, VA, 22186-5141	May 88	Used as needed.
Maintenance and Parts Manual (Shelter)	TM 32-5411-001-24&P	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P, Vint Hill Farms Station, Warrenton, VA, 22186-5141	Mar 88	Used as needed.
Maintenance and Parts Manual (Power Distribution)	TM 32-7050-001-24&P	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P, Vint Hill Farms Station, Warrenton, VA, 22186-5141	Aug 88	Used as needed.
Maintenance and Parts Manual (Antenna Group)	TM 32-5811-008-24&P	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P, Vint Hill Farms Station, Warrenton, VA, 22186-5141	Apr 88	Used as needed.

Maintenance and Parts Manual (Signal Processor)	TM 32-5811-904-24&P	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P. Vint Hill Farms Station, Warrenton, VA, 22186-5141	Aug 88	Used as needed.
Maintenance and Parts Manual (Comm Modem)	TM 32-5811-905-24&P	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P, Vint Hill Farms Station, Warrenton, VA, 22186-5141	Aug 88	Used as needed.
Maintenance and Parts Manual (Interconection Box)	TM 32-5811-906-24&P	Cdr, US Army Communication Electronic Activity, ATTN: SELEM-MR-E-P. Vint Hill Farms Station, Warrenton, VA, 22186-5141	Mar 88	Used as needed.
Training Materials	Training Materials for MOS 33T	Potomac Research Incorporated 6121 Licolnia Road, Alexandria VA, 22312	March 89	Used as formal training at Fort Huachuca, Arizona Prior to testing.
Student Handouts	Operator Guide, PMCS Guide and Student Workbook	Potomac Research Incorporated 6121 Licolnia Road, Alexandria VA, 22312	March 1989	

APPENDIX B

This appendix contains:

1. Student Course Critiques (Operators)
2. Student Course Critiques (Maintainers)
3. Trailblazer MANPRINT Evaluation Questionnaire
4. Operator Comments & Ratings on Operator Training & Manuals, Safety & Health, & Human Factors
5. Maintainer Comments & Ratings on Maintenance Training & Manuals, Safety & Health, & Human Factors
6. Trailblazer Questionnaire for Instructor Personnel
7. Operations Trainer Comments & Ratings on Operator Training & Manuals, Safety & Health, & Human Factors
8. Maintenance Trainer Comments & Ratings on Maintenance Training & Manuals, Safety & Health, & Human Factors
9. End of Course Quiz
10. Trailblazer Operator's Performance Evaluation Checklist

Student Course Critiques

(Operators)

Note: ARI did not have access to these forms. They should be in the test directorate files.

Student Course Critiques

(Maintainers)

COURSE EVALUATION

Title of Course	Period of Training
AN/TSQ-155	From APR 23 Thru MAY 20
Name and Grade (Type or Print): ROTHSTEIN DAVID SSG	Date Form Completed 29 JUN
Unit of Assignment: 1Co. 112th ME Bde	PMOS: 33T3H Years 7 DMOS: 33T3H

The purpose of this course evaluation is to solicit your opinions and ideas concerning the effectiveness of this course.

Contained in this critique are specific questions on the training course which require an answer. Space is provided for your comments. Each NO answer should be substantiated with a comment and explanation. Comments should include examples and specific events. A simple NO answer does not tell what requires correction or improvement. Read and answer each question carefully.

An additional space is provided for any comments or suggestions you may wish to make regarding areas not covered in the critique form. If more space is required, write on the back of the pages.

Questions are listed on the next six pages. These question are broken down into six categories:

1. The Instructor
2. The Lesson
3. The Practical Exercises
4. The Tests
5. The Training Aids (Including Equipment)
6. The Environment.

THE INSTRUCTOR

1.	Vocal qualities: Easy to hear and understand?	YES	(NO)
2.	Did instructor stimulate class interest?	YES	(NO)
3.	Was the instructor willing to assist with problems?	(YES)	NO
4.	Did instructor make logical, non-conflicting statements?	YES	(NO)
5.	Did instructor answer or obtain answers to questions?	(YES)	NO
6.	Did instructor keep to the subject?	(YES)	NO
7.	Was student discussion and participation encouraged?	(YES)	NO
8.	Were students treated fairly and respectfully?	(YES)	NO
9.	Did the instructor act in a professional manner?	(YES)	NO
10.	Was academic assistance provided as needed?	(YES)	NO

Explain negative responses here:

THE INSTRUCTOR WAS VERY DRY AND BORING. DID NOT SEEM TO BE VERY KNOWLEDGABLE ON THE SYSTEM.

SOME STATEMENTS WERE CONTRODICTING BUT THROUGH DISSCUSSION WERE STRAIGHTENED OUT.

Additional comments or suggestions (including positive aspects):

THE LESSON

1.	Did the objectives identify the lesson requirements?	YES	(NO)
2.	Were the lessons well organized and logical?	(YES)	NO
3.	Were the lessons scheduled in a logical sequence?	(YES)	NO
4.	Were technical terms and abbreviations explained?	(YES)	NO
5.	Were adequate examples and applications given?	YES	(NO)
6.	Did the training aids clarify the subject matter?	YES	(NO)
7.	Were the main points of each lesson reviewed?	(YES)	NO
8.	Did the classes start and end as scheduled?	(YES)	NO
9.	Were the teaching methods appropriate for subjects?	(YES)	NO
10.	Was sufficient time available to meet lesson objectives?	(YES)	NO

Explain negative responses here:

No objectives were stated.
NOT ENOUGH EQUIPMENT. "OPERATORS HAD PRIORITY"
WHAT TRAINING AIDS?

Additional comments or suggestions (including positive aspects):

THE PRACTICAL EXERCISES

1.	Did the practical exercise help you understand and perform better?	(YES)	NO
2.	Were sufficient instructors available to assist?	(YES)	NO
3.	Was adequate time allotted for exercise completion?	YES	(NO)
4.	Was the time used to its fullest advantage?	(YES)	NO
5.	Was the equipment operational and usable?	YES	(NO)
6.	Were safety procedures explained and stressed?	(YES)	NO
7.	Was the student progress monitored closely?	(YES)	NO
8.	Was assistance provided when asked for?	(YES)	NO

Explain negative responses here:

MORE TROUBLESHOOTING TIME AND MORE REALISTIC MALFUNCTIONS ARE NEEDED.
ONE SYSTEM ONLY HAD ONE POSITION THE ENTIRE TIME.

Additional comments or suggestions (including positive aspects):

THE TESTS

1.	Were directions self explanatory for all tests?	(YES)	NO
2.	Was a minimum passing score known to the students?	(YES)	NO
3.	Was the grading system explained?	YES	(NO)
4.	Were the test questions easy to read and understand?	YES	(NO)
5.	Was sufficient time allotted for each test?	(YES)	NO
6.	Were all items on the tests covered in the lessons?	(YES)	NO
7.	Did the test results promptly reach the class?	(YES)	NO
8.	Were terms or abbreviations explained prior to the test?	(YES)	NO
9.	Did the instructor review the results/questions after the test?	(YES)	NO

Explain negative responses here:

SOME Questions were messed up

TOO MANY OF THE TESTS WERE REPETATIVE. THEY CONSISTED OF QUESTIONS DEALING WITH WHERE TO FIND INFO. IN THE MANUALS

Additional comments or suggestions (including positive aspects):

THE TRAINING AIDS

1.	Were the Technical manuals easy to read and understand?	(YES)	NO
2.	Were the technical manuals accurate?	YES	(NO)
3.	Were the handouts helpful in understanding the lesson?	(YES)	NO
4.	Was ample supply of note paper and pencils available?	(YES)	NO
5.	Did the visual aids strengthen the subject matter?	YES	(NO)
6.	Was the student guide accurate and useful?	(YES)	NO

Explain negative responses here:

A LOT OF CORRECTIONS HAD TO BE MADE ON THE WIRING DIAGRAMS.

VISUAL AIDS WERE THE SAME AS THE HANDOUT.

Additional comments or suggestions (including positive aspects):

THE ENVIRONMENT

1.	Was the classroom well lighted?	YES	(NO)
2.	Was the room temperature comfortable?	YES	(NO)
3.	Were distracting noises kept to a minimum?	YES	(NO)
4.	Did the seating provide a good view of the instructor/ aids?	YES	(NO)
5.	Was the total environment conducive to learning?	YES	(NO)

Explain negative responses here:

IT WAS A MAKE SHIFT CLASSROOM IN A MAINT. BAY.

Additional comments or suggestions (including positive aspects):

COURSE EVALUATION

Title of Course	Period of Training
Trailblazer Maint Course	From 20 April Thru 19 May 89
Name and Grade (Type or Print):	Date Form Completed
Ware, Kathy L E-4	6 June 89
Unit of Assignment:	PMOS: 33T10 Years 2½
TSC CEWI FtHuachuca AZ	DMOS: 33T10

The purpose of this course evaluation is to solicit your opinions and ideas concerning the effectiveness of this course.

Contained in this critique are specific questions on the training course which require an answer. Space is provided for your comments. Each NO answer should be substantiated with a comment and explanation. Comments should include examples and specific events. A simple NO answer does not tell what requires correction or improvement. Read and answer each question carefully.

An additional space is provided for any comments or suggestions you may wish to make regarding areas not covered in the critique form. If more spac is required, write on the back of the pages.

Questions are listed on the next six pages. These question are broken down into six categories:

1. The Instructor
2. The Lesson
3. The Practical Exercises
4. The Tests
5. The Training Aids (Including Equipment)
6. The Environment.

THE INSTRUCTOR

1.	Vocal qualities: Easy to hear and understand?	YES	(NO)
2.	Did instructor stimulate class interest?	(YES)	NO
3.	Was the instructor willing to assist with problems?	(YES)	NO
4.	Did instructor make logical, non-conflicting statements?	(YES)	NO
5.	Did instructor answer or obtain answers to questions?	(YES)	NO
6.	Did instructor keep to the subject?	(YES)	NO
7.	Was student discussion and participation encouraged?	(YES)	NO
8.	Were students treated fairly and respectfully?	(YES)	NO
9.	Did the instructor act in a professional manner?	(YES)	NO
10.	Was academic assistance provided as needed?	(YES)	NO

Explain negative responses here:

Mr. Williams mumbles and skips over a lot when reading from the lesson plan, making it very difficult to follow the subject.

Additional comments or suggestions (including positive aspects):

THE LESSON

1.	Did the objectives identify the lesson requirements?	(YES)	NO
2.	Were the lessons well organized and logical?	(YES)	NO
3.	Were the lessons scheduled in a logical sequence?	(YES)	NO
4.	Were technical terms and abbreviations explained?	YES	(NO)
5.	Were adequate examples and applications given?	(YES)	NO
6.	Did the training aids clarify the subject matter?	(YES)	NO
7.	Were the main points of each lesson reviewed?	(YES)	NO
8.	Did the classes start and end as scheduled?	(YES)	NO
9.	Were the teaching methods appropriate for subjects?	(YES)	NO
10.	Was sufficient time available to meet lesson objectives?	(YES)	NO

Explain negative responses here:

abbreviations for BITE results weren't explained and were not explained in the manuals ie DS/GS SCAR etc.

Additional comments or suggestions (including positive aspects):

THE PRACTICAL EXERCISES

1.	Did the practical exercise help you understand and perform better?	(YES)	NO
2.	Were sufficient instructors available to assist?	(YES)	NO
3.	Was adequate time allotted for exercise completion?	(YES)	NO
4.	Was the time used to its fullest advantage?	YES	(NO)
5.	Was the equipment operational and usable?	YES	(NO)
6.	Were safety procedures explained and stressed?	(YES)	NO
7.	Was the student progress monitored closely?	(YES)	NO
8.	Was assistance provided when asked for?	(YES)	NO

Explain negative responses here:

Too much time was spent on individual operator tasks. The time would have been utilized more efficiently if all operator tasks had been briefly explained at once and then given a block of time (4 hours at the most) to practice them. The equipment was down frequently. Too many hours were allotted to practice each operator function (ie GS Plan) which only takes minutes to do.

Additional comments or suggestions (including positive aspects):

Splitting us into two groups on alternate schedules during troubleshooting exercises improved the time management. Split shifts would also improve the time spent on operator procedures.

THE TESTS

1.	Were directions self explanatory for all tests?	(YES)	NO
2.	Was a minimum passing score known to the students?	(YES)	NO
3.	Was the grading system explained?	(YES)	NO
4.	Were the test questions easy to read and understand?	YES	(NO)
5.	Was sufficient time allotted for each test?	(YES)	NO
6.	Were all items on the tests covered in the lessons?	(YES)	NO
7.	Did the test results promptly reach the class?	(YES)	NO
8.	Were terms or abbreviations explained prior to the test?	(YES)	NO
9.	Did the instructor review the results/questions after the test?	(YES)	NO

Explain negative responses here:
Some questions were worded obscurely.

Additional comments or suggestions (including positive aspects):
Half of the tests could have been eliminated - namely, the org. level maint, as the questions and answers were identical because the manuals are uniformly arranged.

THE ENVIRONMENT

1.	Was the classroom well lighted?	(YES)	NO
2.	Was the room temperature comfortable?	(YES)	NO
3.	Were distracting noises kept to a minimum?	YES	NO
4.	Did the seating provide a good view of the instructor/ aids?	YES	(NO)
5.	Was the total environment conducive to learning?	(YES)	NO

Explain negative responses here:

I couldn't see the boards and the room was crowded to where I couldn't find a better place.

Additional comments or suggestions (including positive aspects):

THE TRAINING AIDS

1.	Were the Technical manuals easy to read and understand?	(YES)	NO
2.	Were the technical manuals accurate?	YES	(NO)
3.	Were the handouts helpful in understanding the lesson?	(YES)	NO
4.	Was ample supply of note paper and pencils available?	(YES)	NO
5.	Did the visual aids strengthen the subject matter?	(YES)	NO
6.	Was the student guide accurate and useful?	YES	(NO)

Explain negative responses here:
Some of the manuals required a lot of changes. The only parts of the student guide that ~~was~~ were useful at all were the block diagrams (which are in the -10 manual) as I tore them out to put in the -20 manual.

Additional comments or suggestions (including positive aspects):

COURSE EVALUATION

Title of Course	Period of Training
15/G5 Maint. AN/TSQ-133	From Thru
Name and Grade (Type or Print):	Date Form Completed
Schreifels, Kenneth G. E-5	
Unit of Assignment:	PMOS: 33T20 Years 5
TSC (CEWI) 111th MI Bde	DMOS: 33T20

The purpose of this course evaluation is to solicit your opinions and ideas concerning the effectiveness of this course.

Contained in this critique are specific questions on the training course which require an answer. Space is provided for your comments. Each NO answer should be substantiated with a comment and explanation. Comments should include examples and specific events. A simple NO answer does not tell what requires correction or improvement. Read and answer each question carefully.

An additional space is provided for any comments or suggestions you may wish to make regarding areas not covered in the critique form. If more space is required, write on the back of the pages.

Questions are listed on the next six pages. These question are broken down into six categories:

1. The Instructor
2. The Lesson
3. The Practical Exercises
4. The Tests
5. The Training Aids (Including Equipment)
6. The Environment.

THE ENVIRONMENT

1.	Was the classroom well lighted?	YES NO
2.	Was the room temperature comfortable?	YES NO
3.	Were distracting noises kept to a minimum?	YES NO
4.	Did the seating provide a good view of the instructor/ aids?	YES NO
5.	Was the total environment conducive to learning?	YES NO

Explain negative responses here:

Additional comments or suggestions (including positive aspects):

THE TRAINING AIDS

1.	Were the Technical manuals easy to read and understand?	YES	NO
2.	Were the technical manuals accurate?	YES	NO
3.	Were the handouts helpful in understanding the lesson?	YES	NO
4.	Was ample supply of note paper and pencils available?	YES	NO
5.	Did the visual aids strengthen the subject matter?	YES	NO
6.	Was the student guide accurate and useful?	YES	NO

Explain negative responses here:

Additional comments or suggestions (including positive aspects):

THE TESTS

1.	Were directions self explanatory for all tests?	YES	NO
2.	Was a minimum passing score known to the students?	YES	NO
3.	Was the grading system explained?	YES	NO
4.	Were the test questions easy to read and understand?	YES	NO
5.	Was sufficient time allotted for each test?	YES	NO
6.	Were all items on the tests covered in the lessons?	YES	NO
7.	Did the test results promptly reach the class?	YES	NO
8.	Were terms or abbreviations explained prior to the test?	YES	NO
9.	Did the instructor review the results/questions after the test?	YES	NO

Explain negative responses here:

Additional comments or suggestions (including positive aspects):

THE PRACTICAL EXERCISES

1.	Did the practical exercise help you understand and perform better?	(YES) NO
2.	Were sufficient instructors available to assist?	(YES) NO
3.	Was adequate time allotted for exercise completion?	(YES) NO
4.	Was the time used to its fullest advantage?	YES (NO)
5.	Was the equipment operational and usable?	(YES) NO
6.	Were safety procedures explained and stressed?	(YES) NO
7.	Was the student progress monitored closely?	(YES) NO
8.	Was assistance provided when asked for?	(YES) NO

Explain negative responses here:

4) At times the students were just sitting around not doing anything

Additional comments or suggestions (including positive aspects):

THE LESSON

1.	Did the objectives identify the lesson requirements?	YES	NO
2.	Were the lessons well organized and logical?	YES	NO
3.	Were the lessons scheduled in a logical sequence?	YES	NO
4.	Were technical terms and abbreviations explained?	YES	NO
5.	Were adequate examples and applications given?	YES	NO
6.	Did the training aids clarify the subject matter?	YES	NO
7.	Were the main points of each lesson reviewed?	YES	NO
8.	Did the classes start and end as scheduled?	YES	NO
9.	Were the teaching methods appropriate for subjects?	YES	NO
10.	Was sufficient time available to meet lesson objectives?	YES	NO

Explain negative responses here:

Additional comments or suggestions (including positive aspects):

THE INSTRUCTOR

1.	Vocal qualities: Easy to hear and understand?	YES **NO**
2.	Did instructor stimulate class interest?	**YES** NO
3.	Was the instructor willing to assist with problems?	**YES** NO
4.	Did instructor make logical, non-conflicting statements?	**YES** NO
5.	Did instructor answer or obtain answers to questions?	**YES** NO
6.	Did instructor keep to the subject?	**YES** NO
7.	Was student discussion and participation encouraged?	**YES** NO
8.	Were students treated fairly and respectfully?	**YES** NO
9.	Did the instructor act in a professional manner?	**YES** NO
10.	Was academic assistance provided as needed?	**YES** NO

Explain negative responses here:

1) AT times instructor mumbled and often spoke haltingly.

Additional comments or suggestions (including positive aspects):

COURSE EVALUATION

Title of Course	Period of Training
TRAILBLAZER	From 20 APR Thru 20 MAY 89
Name and Grade (Type or Print):	Date Form Completed
MILLIMAN, JASON A. SPC	8 JUN 89
Unit of Assignment: HHSC 105TH MI BN FORT POLK LA 71459	PMOS: 33T10 Years 01 DMOS: 33T10

The purpose of this course evaluation is to solicit your opinions and ideas concerning the effectiveness of this course.

Contained in this critique are specific questions on the training course which require an answer. Space is provided for your comments. Each NO answer should be substantiated with a comment and explanation. Comments should include examples and specific events. A simple NO answer does not tell what requires correction or improvement. Read and answer each question carefully.

An additional space is provided for any comments or suggestions you may wish to make regarding areas not covered in the critique form. If more space is required, write on the back of the pages.

Questions are listed on the next six pages. These question are broken down into six categories:

1. The Instructor
2. The Lesson
3. The Practical Exercises
4. The Tests
5. The Training Aids (Including Equipment)
6. The Environment.

THE INSTRUCTOR

1.	Vocal qualities: Easy to hear and understand?	YES	(NO)
2.	Did instructor stimulate class interest?	YES	(NO)
3.	Was the instructor willing to assist with problems?	(YES)	NO
4.	Did instructor make logical, non-conflicting statements?	(YES)	NO
5.	Did instructor answer or obtain answers to questions?	(YES)	NO
6.	Did instructor keep to the subject?	(YES)	NO
7.	Was student discussion and participation encouraged?	(YES)	NO
8.	Were students treated fairly and respectfully?	(YES)	NO
9.	Did the instructor act in a professional manner?	(YES)	NO
10.	Was academic assistance provided as needed?	(YES)	NO

Explain negative responses here:

#1) Sometimes, each day, the instructor would ~~ramble~~ ramble off sentences, full sentences, etc. It was difficult to follow.

#2) No, because they seemed uninterested ~~themself~~ in the course themselves.

Additional comments or suggestions (including positive aspects):

THE LESSON

1.	Did the objectives identify the lesson requirements?	(YES)	NO
2.	Were the lessons well organized and logical?	(YES)	NO
3.	Were the lessons scheduled in a logical sequence?	(YES)	NO
4.	Were technical terms and abbreviations explained?	(YES)	NO
5.	Were adequate examples and applications given?	(YES)	NO
6.	Did the training aids clarify the subject matter?	(YES)	NO
7.	Were the main points of each lesson reviewed?	(YES)	NO
8.	Did the classes start and end as scheduled?	(YES)	NO
9.	Were the teaching methods appropriate for subjects?	(YES)	NO
10.	Was sufficient time available to meet lesson objectives?	(YES)	NO

Explain negative responses here:

TOO MUCH TIME was allowed for some aspects for Example: It doesn't take 4 days to cover operation procedures!! It should only take about 4 Hours!

Additional comments or suggestions (including positive aspects):

THE PRACTICAL EXERCISES

1.	Did the practical exercise help you understand and perform better?	(YES) NO
2.	Were sufficient instructors available to assist?	(YES) NO
3.	Was adequate time allotted for exercise completion?	(YES) NO
4.	Was the time used to its fullest advantage?	YES (NO)
5.	Was the equipment operational and usable?	YES (NO)
6.	Were safety procedures explained and stressed?	(YES) NO
7.	Was the student progress monitored closely?	(YES) NO
8.	Was assistance provided when asked for?	(YES) NO

Explain negative responses here:

#4) Too much time spent on operational procedures, not enough on troubleshooting.

#5) The equipment was almost always running about 60% efficient. (BASED ON ONLY 3 OUT OF 5 STAYING "UP"

Additional comments or suggestions (including positive aspects):

THE TESTS

1.	Were directions self explanatory for all tests?	(YES)	NO
2.	Was a minimum passing score known to the students?	(YES)	NO
3.	Was the grading system explained?	(YES)	NO
4.	Were the test questions easy to read and understand?	(YES)	NO
5.	Was sufficient time allotted for each test?	(YES)	NO
6.	Were all items on the tests covered in the lessons?	(YES)	NO
7.	Did the test results promptly reach the class?	(YES)	NO
8.	Were terms or abbreviations explained prior to the test?	(YES)	NO
9.	Did the instructor review the results/questions after the test?	(YES)	NO

Explain negative responses here:

TESTS TOO EASY!!

Additional comments or suggestions (including positive aspects):

THE TRAINING AIDS

1.	Were the Technical manuals easy to read and understand?	(YES)	NO
2.	Were the technical manuals accurate?	YES	(NO)
3.	Were the handouts helpful in understanding the lesson?	(YES)	NO
4.	Was ample supply of note paper and pencils available?	YES	(NO)
5.	Did the visual aids strengthen the subject matter?	(YES)	NO
6.	Was the student guide accurate and useful?	YES	(NO)

Explain negative responses here:

#2) There were incorrect annotations throughout manuals pertain. to cable #'s, jack #'s and routing of cables as well a signal flow. I have as many corrections in my manual as I do pages of text!!

Additional comments or suggestions (including positive aspects):

#4) We had to bring our own.

#6) The student guide followed both manuals..... enough said about that!

THE ENVIRONMENT

1.	Was the classroom well lighted?	(YES)	NO
2.	Was the room temperature comfortable?	(YES)	NO
3.	Were distracting noises kept to a minimum?	(YES)	NO
4.	Did the seating provide a good view of the instructor/ aids?	(YES)	NO
5.	Was the total environment conducive to learning?	(YES)	NO

Explain negative responses here:

Additional comments or suggestions (including positive aspects):

Trailblazer MANPRINT Evaluation Questionnaire

TRAILBLAZER MANPRINT EVALUATION

(HUMAN FACTORS, TRAINING, AND SAFETY QUESTIONNAIRE)

Background Information

MANPRINT stands for "manpower and personnel integration." MANPRINT evaluations concern the relation between people and the systems with which they interact. This relation is often referred to as "man-machine interface," although "man-system interface" might be more accurate.

A MANPRINT evaluation may involve six research areas: manpower, personnel, training, human factors, safety, and health hazards. The current Trailblazer evaluation covers four of these areas: human factors, training, safety, and health hazards.

Much valuable MANPRINT information about Trailblazer has already been obtained during this operational test through interviews and other relatively informal observations. The attached questionnaire will be the primary source of formal, or systematic, MANPRINT data obtained for the test. The questionnaire is important because it gives all of the operators and electronics maintainers an opportunity to document for the Trailblazer test report their knowledge and experience of system strengths and weaknesses.

The information you provide here will contribute to a list of "lessons learned" for the developers of future versions of Trailblazer and related systems. Therefore, one of the important purposes of this MANPRINT evaluation is to paint an accurate picture of the current system that illustrates how future related systems can avoid the weaknesses of their predecessor, the AN/TSQ-138 Trailblazer, and capitalize on its strengths.

The questionnaire data will be analyzed by the Army Research Institute, and the summarized results will be provided to the TEXCOM Intelligence and Security Board for inclusion in the overall Trailblazer test report. Subsequently, a separate MANPRINT research report will be published by the Army Research Institute.

* * *

A word of appreciation:

The TEXCOM Intelligence and Security Board and the Army Research Institute are sincerely appreciative of the effort and sacrifice you have put into the Trailblazer test. The hours were long, repetitive, sometimes uncomfortable, and often unrewarding. Nevertheless, the test has been very successful, owing largely to your efforts. Thank you.

INSTRUCTIONS FOR OPERATORS AND MAINTAINERS:

1. Your individual identity as a questionnaire respondent will be not be revealed. The questionnaires will be maintained at the U.S Army Research Institute, Fort Hood, Texas only until they are no longer needed for research purposes.

2. Please make your comments accurate and complete. Provide details, examples, numbers--i.e., good, hard information.

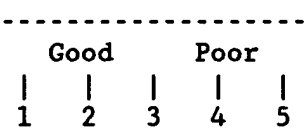
3. You may write on the back of the pages as necessary if you wish to expand on any of your responses. (If you do, be sure to identify the item number to which you comments apply.)

4. Do not skip items unless your related knowledge or experience is limited and your response would not be constructive. Please do skip such items.

5. A few items are for operators only or for maintainers only. Such items are designated {(O)} or {(M)}. If the item number is followed by {(O)}, only operators should answer the item; maintainers should skip it. Conversely, if the item number is followed by {(M)}, only maintainers should answer the time; operators should skip it. If an item has no designator, it is addressed to both operators and maintainers.

6. Check, circle, or fill in all items, as appropriate.

7. IMPORTANT NOTE: On most of the items, you are asked to rate the topic on the following 5-point scale:



where the numbers 1 through five can be interpreted as: very good, good, borderline, poor, and very poor. Please circle one number only, otherwise the rating will have to be discarded. If you feel that the item deserves a poor (4) or very poor (5) rating, it would be very helpful if in the comment space you would briefly explain why and offer any solution or suggestion that you may have.

8. Remember, the information you provide is part of a test of the Trailblazer system. We are not here to make the system look either good or bad. Please do your best to provide objective, accurate information that will be useful in making this system or related systems better in the future.

9. If you feel that your comments on any questionnaire item may contain classified information, DO NOT write that information in the comment section for the item. Instead, write the information on the last page of this questionnaire, which has been provided for that purpose. In your comment, make note of the item number to which your comment applies.

Name: _____

Section 1: Operator's Manual (-10) and Maintenance Manual (-20)

Note: Your answers will apply to the manual that pertains to you as an operator or maintainer--the "dash 10" for operators, the "dash 20" for maintainers.

	Scale				
	Good				Poor
	1	2	3	4	5
01. PHYSICAL SIZE. (Too large? Too small? Handy for storage, handling, etc.?) Comment:	1	2	3	4	5
02. DURABILITY. (Will it hold up in a realistic field environment?) Comment:	1	2	3	4	5
03. QUALITY OF REPRODUCTION. (Print? Legibility? Etc.) Comment:	1	2	3	4	5
04. TABLES OF CONTENTS. (Completeness? Locations? Helpfulness?) Comment:	1	2	3	4	5
05. INDEX. (Can you usually find information quickly and easily? Are there enough entries? Are they logical?) Comment:	1	2	3	4	5

06. READABILITY. (Well written? Easily understood? Etc.) Comment: 1 2 3 4 5

07. LOGICAL FLOW OF MATERIAL within & across sections. (Are things in the right places?) Comment: 1 2 3 4 5

08. FORMAT. (Can one grasp the meaning of the layout at a glance? Do headings stand out? Paragraphs or sentences too long? Arrangement of material on pages? Margins? Size & style of type? Illustrations when needed? Easy to find information on page? Etc.) Comment: 1 2 3 4 5

09. COMPLETENESS. (What needs to be there, but isn't? Are any important warnings, cautions, notes, or technical information missing?) Comment: 1 2 3 4 5

10. APPROPRIATENESS OF CONTENTS. (What is there, but doesn't need to be?) Comment: 1 2 3 4 5

11. ILLUSTRATIONS. (Enough? Too many? Clarity? Size? Location? Legibility of fine print? Etc.) Comment: 1 2 3 4 5

12. {{O}} COMMAND SUMMARY. (Clear? Easy to use? Complete?) Comment: 1 2 3 4 5

13. ACCURACY. (Freedom of errors? Describe errors you are aware of.) Comment: 1 2 3 4 5

14. EASE OF USE as initial training document. Comment: 1 2 3 4 5

15. EASE OF USE as a reference document during operations or maintenance. Comment: 1 2 3 4 5

Section 2: Training

[16-19]. The following four questions concern the completeness and accuracy of your training. Were all needed materials available--such as manuals (for the M1015, the 30 kw generator, the TSU, the ground rod driver, etc.)? Were training aids, devices, and equipment adequate? Was the training lacking in any way?

Scale

Good Poor

16. {(O)} Training for SYSTEM DEPLOYMENT. (Describe any deployment shortcomings--inefficiency, errors, etc.--that occurred during the test that you can trace to the training.) Comment: 1 2 3 4 5

17. {(O)} Training for SYSTEM OPERATION. (Describe any operational shortcomings--inefficiency, errors, etc.--that occurred during the test that you can trace to the training.) Comment: 1 2 3 4 5

18. {(M)} Training for SYSTEM MAINTENANCE. (Describe any maintenance shortcomings--inefficiency, errors, etc.--that occurred during the test that you can trace to the training.) Comment: 1 2 3 4 5

19. Training for TROUBLESHOOTING. 1 2 3 4 5
Comment:

20. TRAINING MATERIALS, AIDS, & EQUIPMENT. (Adequacy for hands-on learning of operational or maintenance tasks.) Comment: 1 2 3 4 5

21. TRAINING PROCEDURES. (Efficient? Effective? Etc. Did they maximize the ease of learning? How could they be improved?) Comment: 1 2 3 4 5

22. Which topics of instruction or critical tasks were most difficult for you or the other students to learn? Why? How could they be taught more effectively?

23. Following training, what percentage of the students (operators or maintainers, as appropriate) do you think could satisfactorily perform 100 percent of the critical tasks at least 90 percent of the time without assistance? (Try to be honest here. Remember, we are evaluating training effectiveness--not individual students.)

Percentage: [_____] Comment:

24. Use of TRAINING TIME. (Was time used efficiently? Could the training take less time? Should it be longer? Why?) 1 2 3 4 5

25. What was the most serious shortcoming, if any, associated with your Trailblazer training? Why?

26. Are there some good techniques you could suggest for Trailblazer training that were not used?

27. Were any especially good techniques used that should be retained in future Trailblazer training?

28. {(O)} Do you think that, for the purposes of training, students would benefit if each were required to act as crew chief during setup and tear down procedures?

[ ] No [ ] Yes Why?

29. Do you have any other comments or suggestions regarding training? What would you change if cost were not a factor?

Section 3: Human Factors--Outside the Shelter

Rate each of the follow items and make comments and suggestions, as appropriate. Here is a list that illustrates the type of things you should consider while rating the items; please read the list carefully and refer back to it as necessary:

- Associated maintenance problems
- Associated training problems
- Ease of use or operation
- Equipment design as it relates to operator or maintainer performance (i.e., human engineering)
- Usefulness or effectiveness
- Labeling
- Location
- Safety
- Strength or height requirements
- Performance in MOPP gear

		Scale				
		Good				Poor
		1	2	3	4	5
30.	VEHICLE LEVELING GAUGES. Comment:	1	2	3	4	5
31.	TSU. Comment:	1	2	3	4	5
32.	TOOLS for outside. (Any missing? Special tools required? Too many required? Storage adequacy? Etc.) Comment:	1	2	3	4	5
33.	GROUND ROD DRIVER. Comment:	1	2	3	4	5

34. GROUNDING STRAPS/CABLES/CLAMPS. (Adequacy?) 1 2 3 4 5
Comment:

35. 30 KW GENERATOR & ITS CONTROLS. 1 2 3 4 5
Comment:

36. 60 KW GENERATOR & ITS CONTROLS. 1 2 3 4 5
Comment:

37. NOISE LEVELS. 1 2 3 4 5
Comment:

38. POWER CABLE SPOOL. 1 2 3 4 5
Comment:

39. POWER CABLE INSTALLATION. 1 2 3 4 5
Comment:

40. POWER CABLE PROTECTIVE CAPS. (Design?) 1 2 3 4 5
Comment:

41. TAILGATE. 1 2 3 4 5
Comment:

42. HAND HOLDS for climbing onto shelter. 1 2 3 4 5
Comment:

43. FOOTSTEP for entering & leaving shelter. 1 2 3 4 5
Comment:

44. EXHAUST PIPE, ENGINE. 1 2 3 4 5
Comment:

45. EXHAUST PIPE, HEATER. 1 2 3 4 5
Comment:

46. WHIP ANTENNAS. 1 2 3 4 5
Comment:

47. MAST TRANSPORT RETAINING FASTENER. 1 2 3 4 5
Comment:

48. ANTENNA SHROUD LATCH. 1 2 3 4 5
Comment:

49. BRUSH GUARD RELEASE. 1 2 3 4 5
Comment:

50. CRANK HANDLE FOR ANTENNA GROUP including shear pin. 1 2 3 4 5
Comment:

51. CRANK HANDLE FOR DIPOLE ELEMENTS. 1 2 3 4 5
Comment:

52. ANTENNA GROUP CLEARANCES when deploying or stowing. 1 2 3 4 5
Comment:

53. DATA LINK ANTENNA ELEMENTS. 1 2 3 4 5
Comment:

54. QUICK-RELEASE PINS. (If you note problems, specify which pin or pins.) Comment: 1 2 3 4 5

55. SADDLE CLAMP SCREWS. 1 2 3 4 5
Comment:

56. ANTENNA HEIGHT LIMITER. 1 2 3 4 5
Comment:

57. MAST CONTROL BOX COVER. 1 2 3 4 5
Comment:

58. MAST CONTROL BOX SWITCHES. 1 2 3 4 5
Comment:

59. MAST ERECTION SWITCH. 1 2 3 4 5
Comment:

60. ANTENNA LEVEL. 1 2 3 4 5
Comment:

61. MAST HYDRAULICS. 1 2 3 4 5
Comment:

62. MAST EXTENSION SWITCH. 1 2 3 4 5
Comment:

63. MAST PNEUMATICS. 1 2 3 4 5
Comment:

64. M1015 TRACK VEHICLE (Suitability for Trailblazer?) 1 2 3 4 5
Comment:

65. Steering the M1015 track vehicle. 1 2 3 4 5
Comment:

66. CPE (collective protection equipment). (What problems have you experienced or do you anticipate?) Consider: weight, supporting brackets, integrity of seal, stability, ease of reach, dust, cover zipper, utility & maintenance of dust cover, deployment procedures, etc.) Comment: 1 2 3 4 5

67. MOPP IV PERFORMANCE <u>outside</u> shelter. (Under realistic field exercise conditions, what effect do you think MOPP IV would have on your performance <u>outside</u> the shelter? Consider: visibility with mask, night vs. day, temperature, installation of whip antennas, manipulating equipment, safety atop shelter, mounting & dismounting shelter, etc. Did you use aids or different procedures to accomplish tasks?) 1 2 3 4 5

Section 4: Human Factors--Inside the Shelter

Rate each of the follow items and make comments and suggestions, as appropriate. Here is a list that illustrates the type of things you should consider while rating the items; please read the list carefully and refer back to it as necessary:

Associated maintenance problems
Associated training problems
Ease of use or operation
Equipment design as it relates to operator or maintainer performance (i.e., human engineering)
Usefulness or effectiveness
Labeling
Location
Safety
Strength or height requirements .
Performance in MOPP gear

		Scale				
			Good			Poor
		1	2	3	4	5
68.	AIR CONDITIONER. (Ventilation? Adequate temperature control? Evenness of air distribution? Inappropriate use of door for ventilation or temperature control? Adequacy of filters? Effect on operator performance? Etc.) Comment:	1	2	3	4	5
69.	EMERGENCY LIGHT. Comment:	1	2	3	4	5
70.	LIGHTING. Comment:	1	2	3	4	5
71.	HEADROOM. Comment:	1	2	3	4	5
72.	STORAGE SPACE within shelter. (Storage for manuals & & other documents? For other items that would normally be present?) Comment:	1	2	3	4	5

73. OPERATOR CHAIRS. (Adequacy for extended shifts? Adjustments? Height? Comfort? Lumbar support? Associated maintenance problems? Etc.) Comment: 1 2 3 4 5

74. WRITING SURFACES. 1 2 3 4 5
Comment:

75. WORK SPACE (for operations or maintenance procedures). Comment: 1 2 3 4 5

76. INTERCOM CONTROLS. 1 2 3 4 5
Comment:

77. HEIGHT OF KEYBOARD. (Too high, too low?--specify.) 1 2 3 4 5
Comment:

78. KEYBOARD TYPING KEYS. (Location of characters? General feel? Etc.) Comment: 1 2 3 4 5

79. KEYBOARD FUNCTION KEYS. (Locations? Feel? Response? Etc.) Comment: 1 2 3 4 5

80. OPERATOR PANEL. (Problems with the following or other factors: Zeroize, Initialize, BITE, Reload, Master Caution, Call, Preamp, Audio Record, Tone Detector?) Comment: 1 2 3 4 5

81. OPERATOR PANEL FOOT SWITCH. Comment: 1 2 3 4 5

82. AUDIO RECORDER. Comment: 1 2 3 4 5

83. AUDIO RECORDER FOOT SWITCH. Comment: 1 2 3 4 5

84. READABILITY OF PLASMA DISPLAY. (Glare? Clarity of characters? Screen clutter? Etc.) Comment: 1 2 3 4 5

85. SPEED OF THE COMPUTER from the user's point of view. Comment: 1 2 3 4 5

86. RECEIVER CONTROL & DISPLAY UNIT. (Ease of use throughout the operator's duty shift? Design adequacy? Location of controls? Etc.) Comment: 1 2 3 4 5

Note: You may wish to rate some of the individual components in your comments. The unit consists of the following components:

Spectrum display & its controls
SPECTRUM WIDTH & ATTEN switches
BFO control & indicator
IF GAIN control
Frequency toggle switches display
RCVR ADDRESS thumbwheels
Spin dial
POWER RESET button
Elapsed time meter
LAMP TEST button
FREQ LOCK button & indicator
POWER switch
RCVR MODE push buttons & indicators
Bandwidth switch & display

87. LIGHTS SWITCH. 1 2 3 4 5
Comment:

88. POWER DISTRIBUTION BOX. 1 2 3 4 5
Comment:

89. BREAKER ACCESS PANEL DOOR. (Method of securing? Location a hazard? Etc.) Comment: 1 2 3 4 5

90. CAUTION PANELS. 1 2 3 4 5
Comment:

91. DMU & HEAD DISK ASSEMBLIES. (Installation? Reliability? Etc.) Comment: 1 2 3 4 5

92. TSEC/KG-45. (Loading? Zeroing? Finger space? Controls? Etc.) Comment: 1 2 3 4 5

93. TSEC/KG-84A. (Loading? Zeroing? Finger space? Controls? Etc.) Comment: 1 2 3 4 5

94. TSEC/KY-57. (Loading? Zeroing? Finger space? Controls? Etc.) Comment: 1 2 3 4 5

95. VOICE LINK TRANSCEIVER. 1 2 3 4 5
Comment:

96. DATA LINK TRANSCEIVER. 1 2 3 4 5
Comment:

97. REPORTING LINK TRANSCEIVER. 1 2 3 4 5
Comment:

98. RADIO SET CONTROLS for Data & Reporting Link Transceivers. (Requirement for screwdriver to adjust? Etc.) Comment: 1 2 3 4 5

Note: You may wish to rate some of the individual controls in your comments. Here is the list of controls:

Main power switch	BW/NB/WB switch
CHAN control & indicator	SQ/MN & SQ/GD switches
MANUAL/PRESET/GUARD switch	PRESET frequency display
SQUELCH OFF/ON switch	TONE push button
PRESET push button	VOL control

99. COMMUNICATIONS MODEM. 1 2 3 4 5
Comment:

100. TUNABLE NOTCH FILTER. 1 2 3 4 5
Comment:

101. TUNABLE DIPLEXER. 1 2 3 4 5
Comment:

102. WATTMETER forward & reverse power. 1 2 3 4 5
Comment:

103. CLOCK. 1 2 3 4 5
Comment:

104. SEARCH RECEIVER. 1 2 3 4 5
Comment:

105. INTERCEPT RECEIVER. 1 2 3 4 5
Comment:

106. Which, if any, particular controls or indicators do operators or maintainers have difficulty identifying (because of location, lack of adequate labeling, infrequency of use, etc.)?

107. {(M)} LABELING OF SYSTEM COMPONENTS. (Which, if any, specific system components [replaceable components, circuits, etc.] could be significantly improved with better labeling or identification? List components that were not properly labeled.) Comment: 1 2 3 4 5

108. For which, if any, system controls or parts is accessibility for operation or maintenance not satisfactory? (Knobs, switches, cables, connectors, circuitry, etc.) List.

109. {(M)} EASE OF TRANSPORTING SYSTEM COMPONENTS. (Weight, shape, etc.) Comment: 1 2 3 4 5

110. Would a list of operator commands placed at a convenient location in front of the operator be a useful addition to the system? In not, why?

111. Which, if any, aspects of the system are likely to induce operator errors or system failure? (Controls, indicators, lights, design, time constraints, or any other human factors, training factors, safety factors, lack of appropriate support.)

112. What are the most difficult aspects of deploying the Trailblazer system?

113. Are there any system components that present significant problems during transport or vehicle movement?

114. {{O}} What are the most difficult aspects of operating the Trailblazer system?

115. {{M}} What are the most difficult aspects of maintaining the Trailblazer system?

116. {{O}} MOPP IV PERFORMANCE inside shelter. (Under realistic field exercise conditions, what effect do you think MOPP IV would have on your performance inside the shelter? Consider: visibility with mask; temperature; manipulating equipment, switches, controls, keyboard, etc. Did you use aids or different procedures to accomplish tasks?) 1 2 3 4 5

117. What software changes would you like to see?

118. {{O}} OPERATING WITH QUICKFIX. 1 2 3 4 5
Comment:

Section 5. Safety and Health Hazards

Are you aware of any safety or health aspects of Trailblazer that may be hazardous to personnel or have a detrimental effect on system employment or maintenance in an operational environment? Make comments and suggestions for the following, as appropriate.

Note: The following scales use 1 to indicate the very safe (very good) situation and 5 to indicate the very unsafe (very poor) situation.

		Scale				
		Safe				Unsafe
		1	2	3	4	5
119.	NOISE LEVELS. Comment:	1	2	3	4	5
120.	CARBON MONOXIDE LEVELS. Comment:	1	2	3	4	5
121.	HEAD CLEARANCE. Comment:	1	2	3	4	5
122.	CLIMBING SURFACES. Comment:	1	2	3	4	5
123.	HOT OBJECTS. Comment:	1	2	3	4	5
124.	CREW SEAT BELTS. Comment:	1	2	3	4	5

125. MOVING MACHINERY. 1 2 3 4 5
Comment:

126. ELECTRICAL SHOCK HAZARDS. 1 2 3 4 5
Comment:

127. RF ENERGY. 1 2 3 4 5
Comment:

128. HANDHOLDS. 1 2 3 4 5
Comment:

129. FOOTHOLDS. 1 2 3 4 5
Comment:

130. SHELTER FOOTSTEP. 1 2 3 4 5
Comment:

131. SHARP OR POINTED OBJECTS. 1 2 3 4 5
Comment:

132. GLARE. 1 2 3 4 5
Comment:

133. LIGHTING ADEQUACY. 1 2 3 4 5
Comment:

134. GROUND ROD DRIVER. 1 2 3 4 5
Comment:

135. GROUNDING CONNECTIONS. 1 2 3 4 5
Comment:

136. SEAT BELTS. 1 2 3 4 5
Comment:

137. WALKING & CLIMBING ON VEHICLE OR SHELTER SURFACES. 1 2 3 4 5
Comment:

138. SAFETY COVERAGE IN OPERATOR'S & MAINTENANCE MANUALS (warnings, cautions, etc.) Comment: 1 2 3 4 5

139. OVERALL SAFETY OF TRAILBLAZER SYSTEM for operating or maintaining? Comment: 1 2 3 4 5

140. What problems regarding safety or health hazards should be addressed in the operator's (or maintenance) manual but are not?

POTENTIALLY CLASSIFIED INFORMATION

Do not write potentially classified information on any other page.

Operator Comments & Ratings on Operator Training & Manuals, Safety & Health, & Human Factors

TABLE B-1. (U) OPERATOR RATINGS & COMMENTS: OPERATOR'S MANUAL (-10)

No.	Rtg	Topic [% responding with comments]: Gist of comments
002	3.4	DURABILITY [73%]: Needs better binding; fell apart. Won't withstand adverse field conditions.
004	2.7	TABLES OF CONTENTS [47%]: (a) Poor organization; all contents should be at beginning of manual. (b) Never used it.
006	2.6	READABILITY [27%]: Poorly written; confusing, technical. Poor illustrations; difficult to locate parts.
009	2.6	COMPLETENESS [33%]: (a) Needs better & more coverage of trouble-shooting. Needs section on interoperations. (b) Needs more explanation of "why." (c) Didn't use enough to know.
011	2.6	ILLUSTRATIONS [53%]: (a) Poor legibility. Confusing. (b) More needed. Need to be more informative in equipment description section. (d) Adequate; good.
014	2.6	EASE OF USE as initial training document [53%]: (a) Initially, very hard to follow; hard to connect with reality. Assumes technical vocabulary of beginner. (b) Doesn't answer "whys" & "whats." (c) Far from ideal, but exceeds most others. Okay, except for errors & required change pages. Very helpful. (d) Didn't use.
015	2.6	EASE OF USE as a reference document during operations or maintenance [60%]: (a) Can be hard to find information fast; insufficient index & inconsistencies in terminology. Found information quickly. (b) Almost useless. Fair to good for experienced operator. (c) Too bulky; no adequate reading space.
001	2.5	PHYSICAL SIZE [40%]: Too large, bulky. Unnecessary detail.
005	2.5	INDEX [33%]: (a) More useful than tables of contents. (b) Too general; not enough detail.
007	2.5	LOGICAL FLOW OF MATERIAL within & across sections [20%]: Perhaps logical; sometimes didn't follow order of operational procedures.
008	2.3	FORMAT [33%]: (a) Good. (b) Subject headings should stand out more. (c) Difficult unless you already know system.
010	2.2	APPROPRIATENESS OF CONTENTS [27%]: [Comments not substantive.]
013	2.2	ACCURACY [40%]: (a) Needs revision to correct errors & add changes in change sheets. (b) Don't know enough about system to know.
003	2.1	QUALITY OF REPRODUCTION [20%]: Illustrations fuzzy; not legible.

TABLE B-1. (U) OPERATOR RATINGS & COMMENTS: OPERATOR'S MANUAL (-10)
(Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
012	2.0	COMMAND SUMMARY [53%]: (a) Unaware of it; didn't use. (b) Poor logical arrangement. Make into two sections: basic memory aid & in-depth explanations. (c) Good, but has errors. Complete, clear.

TABLE B-2. (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER TRAINING

No.	Rtg	Topic [% responding with comments]: Gist of comments
024	3.2	Use of TRAINING TIME [93%]: (a) Time was wasted because of informality of training & because training was not individualized to account for slower & faster learners. A lot of time was wasted waiting around for turn at computer--split shift would have been more efficient. Time could be cut by substituting more hands on in place of classroom training. Should be shorter. (b) Extend training--it was "too much, too soon." [Should be] somewhat longer to include more hands on. Spend more time overall--add a few days of theory of operation & meaning of software terminology. Students should not be rushed beyond their natural learning speeds. (c) Should stress mission oriented issues; organize around mission, not around order in TM. (d) Not effective. (e) adequate.
019	3.1	Training for TROUBLESHOOTING [73%]: (a) The only troubleshooting training provided was advice to recycle power [in case of a problem], which does seem to be most effective procedure. Can't recall receiving any; minimal; not enough. With more trouble-shooting training, much downtime could have been avoided. "I don't know what troubleshooting is." Material in manual was taught, which is too limited. Training was, at best, sufficient only for general background knowledge. "There is no troubleshooting guide/check-list." No hands-on troubleshooting training. "There's nothing worse than having a mech arrive on site & [solve problem by simply pushing] a circuit breaker you were never told of (like the AC) & making you look stupid." (b) Adequate.
016	2.9	Training for SYSTEM DEPLOYMENT [47%]: (a) Training for use of ground rod driver was insufficient. (b) Not taught to ensure clearance for carrier doors when parking next to trees, etc. (c) Lack of effective communication between those in charge & team leaders.
021	2.9	TRAINING PROCEDURES [93%]: (a) Trainers should be knowledgeable about intel field have a good understanding of how system physically works--more than just what is in lesson plans. They should be able to explain "why." ("Yes, this button is here, & it calls up GS histogram, but why would I want to [do that], & how will it improve my mission?") (b) Too much detail about how to use computer--we "don't need to know everything about how it works, just [enough] to gist & DF." "Too many specialized terms were used by instructors, who had become too familiar with procedures ('Everybody knows what a peabody clamp is!')". "Too much, too soon." Topics should be outlined ahead of time for students; this would aid in grasping current material in knowing what will be coming later. (c) Too much wasted time waiting around for computer to become available. Too many people in shelter at one time--distracting. Needed more hands on & less class time. (d) Generally, training was very structured & extremely effective. Questions fielded willingly. Adequate; very good with respect to MCS system training.

TABLE B-2. (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER TRAINING (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
017	2.7	Training for SYSTEM OPERATION [67%]: (a) Limited explanation of concepts of system operations; taught to push buttons without being told why. Trainers should have good knowledge of 98G field; otherwise, they cannot answer certain questions effectively. (b) A lot of time spent on learning to link with a TCAE (TCAC) that was never used. More often than not, we were unable to link sets, which made understanding of some concepts difficult. (c) Three different sequences for circuit breakers were taught; a particular sequence should have been determined prior to start of training. (d) Some training occurred during test, rather than prior to it; e.g., during test, we were taught to go to gist page while taking DF in order to see DF results. (e) Operator's manual was presented as an additional resource, not as a viable training aid: Many problems (forgetfulness, requirements for troubleshooting, etc.) could have been easily referenced had training included an overview of manual. Manual was not taught as a source of information about corrective actions to take in response to error messages. (f) Training was thorough; good for most part.
020	2.6	TRAINING MATERIALS, AIDS, & EQUIPMENT [73%]: (a) Operator's Guide [not -10 manual] not helpful to trainees--it was just an outline for trainers; it was not up to date with current changes. (b) Materials were adequate, fine, except when there were conflicts between books & instructor's information. Didn't use much. (c) Best aid is hands on time, of which there was plenty. Most important tasks occurred in crowded area in which good view was impossible; training manual didn't help. (c) Insufficient hands-on with ground rod driver. (d) Need more time after training for practice before going to field test. (e) "Workbook was unnecessary."
022	n/a	WHICH TOPICS OF INSTRUCTION OR CRITICAL TASKS WERE MOST DIFFICULT FOR YOU OR OTHER STUDENTS TO LEARN? WHY? HOW COULD THEY BE TAUGHT MORE EFFECTIVELY? [67%]: (a) Gist & report modes: "Not user friendly enough." Should act more like a word processor. (b) Operation of carrier vehicle: "Needs to be trained separately." Detracted from Trailblazer system training, because it was not an official part of course. (c) "Powering up hut. Why can't circuit breakers be in order?" (d) "Collective protection equipment. No hands-on training." (e) Operator maintenance--bad instructor. (f) Creating & sending messages--bad instructor. (g) Interoperability. (h) "We followed a pattern of lecture, hands on, spot review. Initial lectures were pointlessly detailed--including much information that couldn't be comprehended until a hands on experience. Much of that time would have been better spent in a more thorough review & reinforcement following hands on." (i) Practical exercises were too irformal, followed whim of instructor; need more structured agenda.

TABLE B-2. (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER TRAINING (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
023	n/a	FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME WITHOUT ASSISTANCE? [93%]: [The mean response to this question was 66%.] (a) 100% if tested immediately; without practice, would lose 5 to 10% in 5 days, 20 to 30% in 2 weeks. (b) "I was confused with info we were given; instructors lack of knowledge . . . left a lot of important questions hanging." (c) "Though almost all understood each block of instruction, a comprehensive grip of concepts & details didn't come until a couple of weeks into test. There was a lot of transference & confusion of concepts & commands from one function to another--because training was rapid & didn't include reinforcement/review beyond initial understanding." (d) "Lack of time on system & formal practical exercise." (e) Problem-solving experiences should be distributed more equitably among students.
025	n/a	WHAT WAS THE MOST SERIOUS SHORTCOMING, IF ANY, ASSOCIATED WITH YOUR TRAILBLAZER TRAINING? WHY? [93%]: (a) 43% of respondents noted quality of trainers as most serious training problem: "Instructors' lack of experience in our carrier field." Instructors "were not 98G's; in fact, majority . . . weren't even in military intelligence." "Problems with one of instructors . . . who is probably working at a carwash by now." "Quality of trainers was very uneven." Instructor lacked "knowledge of overall DF mission technique." (b) "Inadequate maintenance support." "Poor maintenance training [for M1015A]; we spent plenty of time on it, but it doesn't matter if you don't get hands on training where you can see & touch what you're reading about." (c) Lack of realism: Training should have been structured around requirements of a real mission. "Systems should have been taken out to different sites instead of doing just a portion of setup & tear down procedures in same position every day." (d) Safety hazard: "Soldiers who had no previous experience with tracked vehicles were given only one day to learn & become proficient with system carriers. This is a grave safety deficiency." (e) "There was also a severely limited amount of instruction concerning maintenance of carriers. [Trailblazer] is of no use when sitting in garrison on a broken vehicle." (f) "Spent too much time on little details." "Operators were hurried."
026	n/a	ARE THERE SOME GOOD TECHNIQUES YOU COULD SUGGEST FOR TRAILBLAZER TRAINING THAT WERE NOT USED? [60%]: (a) Better orientation & realism: "Set up a net, & show novice operators [at] outset what will be expected of them." "Work mission-work under time pressure. Best way to learn something is when you have to know it." "More hands-on training, less classroom." Teach interrelations among functions; don't teach interrelated functions as isolated tasks.

TABLE B-2. (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER TRAINING (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		A dipstick that reads empty doesn't mean much if you don't know what that fluid does." Operators were never really taught what they were for. Use "demonstrations & formalized practical exercises with a standardized result/solution." Need "one-on-one maintenance training [for M1015A]." (b) "Students helping students. This has been shown to be an effective learning technique" that benefits both student & instructor." "Utilize [available] expertise . . . e.g., SSG [name] trains this system at Fort Devens but had to sit through two weeks listening & keeping quiet." (c) Employ individualized instruction & move students from one group to another rather than keeping people in same groups day after day. Use split training shift so that students don't have to wait around "doing nothing, waiting to get on position."
027	n/a	WERE ANY ESPECIALLY GOOD TECHNIQUES USED THAT SHOULD BE RETAINED IN FUTURE TRAILBLAZER TRAINING? [73%]: (a) 64% of respondents stressed importance of hands-on training. (b) "Safety precautions." (c) "No."
028	n/a	DO YOU THINK THAT, FOR THE PURPOSES OF TRAINING, STUDENTS WOULD BENEFIT IF EACH WERE REQUIRED TO ACT AS CREW CHIEF DURING SETUP AND TEAR DOWN PROCEDURES? [ ] No [ ] Yes WHY? [100%]: [40% voted "No"; 60% voted "Yes."] (a) Yes: "Not necessarily as crew chief, but . . . everyone should have opportunity to perform all related subtasks." "It would be good as long as students helped train each other . . . & were not tested or graded." Produces better system awareness, understanding, efficiency. (b) No: "It leads to problems when lower ranking soldiers are put in charge of higher ranking soldiers." "Teamwork should be promoted, not 'who's in charge.'" Requires teamwork, not leadership. Rotate tasks, not authority. "Best thing we did was rotate setup responsibilities; our 'crew chief' always participated."
029	n/a	DO YOU HAVE ANY OTHER COMMENTS OR SUGGESTIONS REGARDING TRAINING? WHAT WOULD YOU CHANGE IF COST WERE NOT A FACTOR? [80%]: (a) Better instructors: "I think that operators should be taught by other operators--not civilian contractors. . . . They don't understand what it is that operator needs to know . . . . Army should send potential Trailblazer operators to F-20 course at Fort Devens where millions of dollars have been spent on a simulator which can train internal operations of Trailblazer quicker [&] more efficiently, & where they can be trained by experienced senior NCOs who are also 98Gs." "An hour with some of trainers was more beneficial than a day with others." Instructors should use "a more formal approach to DF operations." (b) "One-on-one maintenance training [for track]." Need more driver training for track. (c) Provide for more hands on, more computers; eliminate written evaluation; test as teams. "A mere talk through on an inoperable ground rod driver is

TABLE B-2. (U) OPERATOR RATINGS & COMMENTS: TRAILBLAZER TRAINING
(Continued)

No.	Rtg	Topic [% responding with comments]:	Gist of comments
			more of a safety hazard than a for-your-info class. (d) Provide "actual [operator's manuals] (not abbreviated handouts"; these should include [manuals for] 30 kW generator, M1015A track carrier, & all system components. (e) "I would . . . do away with [procedure in which instructor reads] task, conditions, & standards during training, [as well as approach in which instructor says,] 'this is what we have covered at this time, you should be able to . . . Are there any questions?' This insults one's intelligence & is boring; [it is] unnecessary to be so book specific & formatted." (f) Shorten course. (g) "Don't put so much pressure on students to rush! (h) "Much unnecessary tension on my team" was created by fact that there were not enough sets of MOPP gear to go around; consequently, one team member did not have to suit up in "110 degree weather."

UNCLASSIFIED

TABLE B-3. (U) OPERATOR RATINGS & COMMENTS:
HUMAN FACTORS--OUTSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
066	4.8	CPE (collective protection equipment) [87%]: Unsatisfactory with respect to weight, supporting brackets, integrity of seal, stability, ease of reach, dust cover zipper, utility & maintenance of dust cover, & deployment procedures. "Extremely dangerous." Support brackets too weak, broke during training. Instructors "almost lost control (& almost seriously injured themselves) trying to erect [it]. They never could form a seal." "Very time consuming." "Extremely cumbersome." "Complicated operation." "Too heavy." "No integrity of seal." "It is a totally worthless piece of equipment!"
043	4.0	FOOTSTEP for entering & leaving shelter [100%]: [See also item 130.] (a) May be seriously damaged from sharp turns & jackknifing with TSU. "Structurally weak"; bolts came out. "Piece of doo-doo." Should be made to fold up & out of way during transit. "(b) "Safety hazard": Once damaged, becomes more hazardous than normal. Even undamaged, unsafe because of small size & height; "too high for short soldiers." "Small & easy to miss when in hurry or under poor visibility conditions [such as] night & MOPP 4." "Extraordinarily slippery when wet or muddy." (c) Need additional step below this one. Replace with ladder.
037	3.9	NOISE LEVELS [93%]: (a) "Ha!" "Painful." "60 kW ridiculous for tactical environment." "Headaches abound." "Hardly tactical." "Entirely too noisy for tactical system." "The bad guys will be able to hear it from long way away." Both generators too loud. Ear protection a must. Impractical for anywhere near front line. (b) With 60 kW, communications inside shelter restrained. (c) "How about a better muffler?" "There are a lot of quiet, more reliable, smaller generators on market which can fill same requirements." (d) Will affect crew rest.
064	3.9	M1015A TRACK VEHICLE (Suitability for Trailblazer?) [93%]: (a) Too slow; not built for weight of load: "Five mph up steep hills! Should be called 'Snailblazer.' "Can't keep up with armored & mechanized units it is supposed to support." "Maximum speed on flat road 20 mph . . . downhill, 36 mph." Normal speed: 12-15 mph. "Can't keep up with other Army equipment in convoy." (b) "Strain on engine & transmission to be run at maximum rpm." "Underpowered, underprotected, over tall, over aged." Overweight. (c) "Center of balance seems too high." "Top heavy." Limited maneuverability (especially with TSU); limited deployability. "Setup with TSU in small area too difficult given need for level ground."
033	3.6	GROUND ROD DRIVER [87%]: [See also item 134.] (a) Very unreliable; works well only in soft ground; not effective in hard ground. "[Would] probably work in a swamp." Not powerful enough: Team member often has to stand on top & ride it down to put enough pressure on driver--dangerous!" Sledgehammer more practical. "In

TABLE B-3. (U) OPERATOR RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		Germany (two years), I never saw a ground-rod driver that worked properly." (b) Cables not sufficiently protected from damage; electrical connections break. Connector on control box (on deck behind cab) should be protected; it gets stepped on & broken. (c) Training insufficient. (d) Worked adequately three times we used it. Didn't use.
039	3.6	POWER CABLE INSTALLATION [80%]: (a) "Weak link in whole system." Very to extremely difficult to install--especially for smaller persons, especially at shelter end, especially in MOPP IV. Poor angle, hard to reach, cable clutter. Hard to match up; have to "wiggle" it into place. Requires two people. Much time could be saved during setup if easier cable installation were possible. Why can't TSU end remain connected? (b) "Locking ring on shelter end uses reverse threads!" Threads need to be larger. (c) There is a ladder, but why not a step on side of vehicle instead?
042	3.5	HANDHOLDS for climbing onto shelter [80%]: (a) "What handholds?" Need handholds for climbing along sides of shelter, reaching whip antennas, releasing tie-downs. Lack of proper handholds is a "safety hazard." Need handhold forward, curbside: Currently, only thing to reach for is 524 mount, tie-down cable, or exhaust. Could use built-in ladder on either side. Current situation inadequate for short persons.
053	3.5	DATA LINK ANTENNA ELEMENTS [80%]: (a) Ground plane elements break off easily during vehicle movement: "We lost some almost every time we deployed." We lost several during every deployment." Some sort of protective cover (canvas; extension of shroud, etc.) would help. Need to be stronger. (b) Part of problem is lack of adequate clearance for elements when antenna group is stowed or deployed. "No problem when brush guards are installed properly." (c) Because data link star must be removed prior to vehicle movement, could get lost; should be permanent. (d) "No problems."
038	3.4	POWER CABLE SPOOL [87%]: (a) "Tedious," "cumbersome," "very heavy," "awkward." Physically demanding for smaller person. Slow installation, especially in MOPP gear. (b) Spool too small to hold cable easily. Speed of spool needs to be governed ("hold tension on spool") so that one person can operate; requires two persons. Cable connector that fits inside spool falls out, gets caught; need strap or something to hold it in place. (c) Needs to be protected from being covered with mud from track during movement.
048	3.4	ANTENNA SHROUD LATCH [73%]: "Inexcusably configured to be difficult to use." "We could never get ours to work properly." Often stuck; it locks shroud open or closed. "Ours broke twice." "If a quick

TABLE B-3. (U) OPERATOR RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		redeployment or escape is needed in a tactical situation, you're screwed if you can't stow your antenna."
049	3.4	BRUSH GUARD RELEASE [80%]: (a) Safety hazard: "Handle busted off in my hand . . . I went flying off top rail of vehicle." [Handle] broke twice; fell off once. "Very weak design." Not strong enough for force required to operate it. (b) Handle too small for good grip. Difficult to lock open because of inaccessibility. Some easy, some difficult--varies from set to set. "I find it easier to walk down to end of shroud & push brush guard down with my hand & pull antenna past it manually."
036	3.2	60 KW GENERATOR & ITS CONTROLS [80%]: (a) Too unreliable for sustained operations; engine speed of 2300-2500 rpm too fast, too hard on engine, for sustained operations. (b) Much too noisy; "This system will not survive in a wartime situation long enough to be effective. Aerial & long range surveillance will find it with no problems." Decreases chances of survival by increasing chance that track will be inoperable. (c) Too much chance of vehicle falling into gear & out of control. Need a transfer-case decoupler to avoid accidentally putting track in gear during operations. (d) "Important: Emergency stop button needs to be usable even when main power switch in track is off." (e) Why 60 kW? Too much outage, too much gas, too loud in & out of shelter. (f) Simple, easy.
041	3.2	TAILGATE [87%]: (a) Often very difficult to open & close; a "big pain." Latching mechanism awkward, inadequate: poor design; requires strength beyond abilities of some persons; a two-person job. (b) In sites with obstructions, may not be able to opened completely; in such instances, needs to be tied to bush or something. Can't be opened with TSU hooked up. (c) "Why not just remove it?" "Unnecessary."
047	3.2	MAST TRANSPORT RETAINING FASTENER [67%]: Very difficult (impossible sometimes) to operate--especially for shorter soldiers who find it hard to get appropriate leverage. Sometimes requires great strength because of close tolerances (stiffness) & pressure (misalignment) applied to mechanism by weight of antenna group. One was removed because it could not be operated.
067	3.2	MOPP IV PERFORMANCE <u>outside</u> shelter [93%]: (a) Safety hazard: "Very hazardous on top of shelter." "Extremely dangerous! I personally was 'left hanging' because my overjacket & boot was caught on various screws & hoses (climbing down from top to engine platform)." Hazard of falling, especially when working with whip antennas at night. Lack of handholds, built-in ladders. (b) Limited visibility & peripheral vision. "At night, one could

TABLE B-3. (U) OPERATOR RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		barely see." "Difficult to give directions to front ground guide for connecting track to TSU." "Most difficult [task] is backing vehicle up for connection to TSU at night." "Lunette & hitch are very difficult to align." "Much more difficult to connect cable." (c) "Day temperature almost unbearable"; "dangerous." (d) "Greatly reduces speed, agility." Slows things down, of course, but that's to be expected. (e) With properly trained crew & prearranged signals, operations can be accomplished adequately; just need to exercise extra caution to overcome limited visibility & to gain footing in MOPP boots.
040	2.9	POWER CABLE PROTECTIVE CAPS [53%]: (a) Cap connecting chains are too short for easy installation of caps; chain gets stiff, sticks. Chain was sharp--cut operator's hand [see also item 131]. (b) Caps are annoying, difficult, problematic, time consuming. Caps do not completely cover threads, which get encrusted with mud & dirt.
044	2.9	EXHAUST PIPE, ENGINE [73%]: (a) "Very awkward location . . . very hot following movement; easy to bump into when climbing up [onto shelter]." Needs to be redirected (taller?) so it doesn't blow on 524 antenna mount area & antenna control box; a burn hazard, because tempting to use hot pipe as handhold. Noise, heat, & breathing problem when running on-board generator & deploying antenna; exhaust in face. When driving slow, exhaust sometimes blows in passenger window. (b) Black soot covers front curbside of shelter; a real mess; soils uniforms. Black soot all over front curbside of shelter.
052	2.9	ANTENNA GROUP CLEARANCES when deploying or stowing [60%]: (a) Places undesirable constraints on site selection: "20 feet forward & 30 feet to driver's side could be difficult in real tactical situation." "Concealed (better) positions would be easier to find with an antenna like EFVS has." (b) Location of ground rod driver interferes with antenna group deployment: "Since our ground rod driver never worked, I would have removed it & saved myself hassle of cranking elements to clear top of driver." (c) Antenna sag causes difficulty cranking antenna group in & out of shroud--sometimes requires two persons.
031	2.8	TSU [80%]: (a) "Basically hard to maintain, hard to set up & tear down." "Requires a lot of troubleshooting & maintenance"--more knowledge needed. (b) Power cable difficult work with--heavy, cumbersome, gets covered with mud, has to be unearthed. (c) Locking pins for legs not sturdy, difficult to pull out. Problems with greased legs locking up. Legs slip in mount, then can't be raised. Legs themselves get stuck; requires more strength than some have. (d) Need more durable breaker bar for changing tires. Because TSU is on tires, it can't go places track can--no sense. (e) Lunette on

TABLE B-3. (U) OPERATOR RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		track (ring that couples with trailer tongue) is very difficult to align with trailer tongue, especially on uneven ground, in poor light, etc.; this is most time-consuming part of setup & tear down procedures. (f) "Too heavy & too loud for a tactical environment." (g) "Storage door latches too frail, bend easily, came open during transport." Fold-up doors on generator pose a hazard to fingers. (h) Steps should be installed for climbing on front or rear of trailer. (i) Generator itself operates "like a champ". (j) "Easy to use whether in MOPP gear or not."
065	2.8	STEERING THE M1015A TRACK VEHICLE [40%]: (a) "Challenging on downward slopes because of weight." Pivot steering is a problem because you momentarily lose control while switching controls. "A royal pain." (b) Insufficient training; otherwise adequate.
054	2.7	QUICK-RELEASE PINS [67%]: (a) Dipole antenna release pin is too high because mast has been raised to clear ground rod driver. Would help if pin were on underside of antenna rather than on top. (b) Antenna height limiter pin difficult to manipulate because of lack of space for hand. (c) Retaining cables on pins break off & pins get lost. Antenna height limiter pin: "Missing." "Broken off." (d) They get bent & become difficult to remove or insert. "Our [antenna height limiter] pin could not be forced into limiting position. (e) Okay.
056	2.7	ANTENNA HEIGHT LIMITER [27%]: (a) "Worthless." "Ours got broken." (b) [See Item 54 b-d.]
034	2.6	GROUNDING STRAPS/CABLES/CLAMPS [67%]: (a) Good or adequate if alligator clamps are provided; clamps often missing; bolt clamp requires too much time. (b) Not durable. Ground rods bend in bolt cap while being driven, then can't be removed to add another section. (c) Straps & clamps vary from system to system, but commonly seem to be too short; should be at least 12 feet long. (d) Needs to be consensus on location of TSU with respect to carrier; we were taught T formation, then instructed to orient differently for test.
045	2.6	EXHAUST PIPE, HEATER [67%]: (a) Not used. (b) "Could be a major safety problem if heater is used." (c) Tends to be used as a handhold for climbing--needs to be more sturdy.
060	2.6	ANTENNA LEVEL [80%]: (a) A two-person job to level mast; should require only one. Angle should be able to be read at control box; control box (or another control box) could be situation at base of antenna. (b) Reading level: "If one isn't tall enough, forget it." Safety hazard: "I had to lean out, stand on my toes, hold part of shelter with one hand & signal with other." "Requires

TABLE B-3. (U) OPERATOR RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		precarious position." (c) Readability: "Hard to read at night & in MOPP 4. Need light or luminous markings for night operations. (d) An electronic level light at control box would require only one person & could be easily seen at night. (e) Antenna should stop automatically when it is level.
030	2.5	VEHICLE LEVELING GAUGES [53%]: (a) "Hard to read." Not visible to driver through plastic window of cab. Scratches on plexiglass made them difficult to read. Had to be cleaned frequently. (b) Bad location. Operators should not have to climb on vehicle to read. Should be lower for easy reference. (c) "One [gauge] in cab should be able to gauge entire system" to cut down on time.
046	2.5	WHIP ANTENNAS [60%]: (a) Safety hazard: Guard & HF antennas should be mounted permanently to base of mast for speed of installation & reduction of fall hazard created by present location of whip antennas; is especially important for MOPP & night operations. All whip antennas are dangerous to deploy, because individual must climb over & around things not designed for walking on. "Extreme care necessary [when] installing & removing whip antennas in MOPP or darkness." (b) Safety hazard: RT-524 antenna base should be designed to pivot 45 degrees rearward during travel to minimize danger when tie-down clip pops off accidentally; otherwise poses an electric shock hazard [from power lines]. (c) Safety hazard: All whip antennas should have safety balls on tips; otherwise serious injury possible. (d) Time consuming setup; provision of tie-downs would reduce installation time & increase operator safety.
055	2.5	SADDLE CLAMP SCREWS [60%]: (a) Needs to be a latch of some sort rather than a screw; screw is sometimes hard to align & requires too many rotations. (b) Screw is too close to shroud: "A couple of times I've lost skin." (c) No problems.
061	2.5	MAST HYDRAULICS [53%]: (a) Two slow. "3-5 minutes--time is critical in actual mission." Gets slower with repeated use during short periods of time--looses pressure. (b) "Good."
063	2.5	MAST PNEUMATICS [33%]: (a) "Sometimes sticks coming down, then slams hard when it [releases]." "I was told by maintenance to operate . . . so that when extending or lowering mast, I cushioned impact of section rings by placing switch in pause just before impact; otherwise rings could crack. This seems height of ridiculousness. If rings are going to crack under normal use from antenna going up or down, then they need to be redesigned!" (b) Needs "larger compressor or air storage; pressure is lost & reaccumulates much too slowly." (c) "Normally sufficient & fairly rapid."

TABLE B-3. (U) OPERATOR RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
050	2.4	CRANK HANDLE FOR ANTENNA GROUP including shear pin [47%]: (a) Pin can break from normal force applied while deploying or stowing antenna group. (b) Response lag exists between rotation of crank & movement of antenna group. (c) Need directional arrows to indicate proper direction to turn handle. (d) "Easy enough to use."
051	2.4	CRANK HANDLE FOR DIPOLE ELEMENTS [47%]: (a) Hard to reach; requires operator to stand balanced on cab cover-frame, which is not designed for such use. (b) "Handle fell off once." (c) "Wheel too small." (d) Need directional arrows to indicate proper direction of rotation. (e) "Easy to use"; "good."
035	2.3	30 KW GENERATOR & ITS CONTROLS [67%]: (a) "Much too noisy." (b) Actuator/speed increaser non-operational. Students should be told about frequency adjuster during training. (c) Batteries hard to access; perhaps sliding tray would help. Difficult for short person to reach controls, even when standing on step. (d) Many problems at first, then none. Adequate, easy, simple; good controls.
032	2.2	TOOLS for outside [33%]: (a) A tool for tightening data link ground plane elements is needed. (b) Current locations for storage of OVM make accessibility very inconvenient. (c) Tools were adequate except for some missing at first (e.g., sledgehammer). Only used breaker bar.
057	2.2	MAST CONTROL BOX COVER [53%]: (a) Hinges not appropriate: Current hinges allow cover to come off easily & force operator to realign cover before closing. (b) One clamp (butterfly) would suffice. (c) "Not waterproof." "Subject to being frozen shut by ice." Needs to be in a more sheltered location. (d) "Adequate."
059	2.1	MAST ERECTION SWITCH [47%]: (a) Should not be a deadman switch; it should remain in position selected until manually reset so that operator doesn't have to hold it while antenna is being raised or lowered; would free operator for other functions such as erecting whip antennas. Should be a two-throw switch ("Mast IN/OUT") that trips when mast has reached its destination. (b) No problems.
062	2.0	MAST EXTENSION SWITCH [27%]: (a) "After extending mast, switch must be returned to pause. Why? There should be only 'in' & 'out' & a circuit breaker to prevent antenna from going up after power failure when power is first restored." (b) "No problems."
058	1.9	MAST CONTROL BOX SWITCHES [27%]: (a) Should be able to lock some of switches into standard positions to prevent operator mistakes. (b) Adequate; no problems.

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
118	3.4	OPERATING WITH QUICKFIX [100%]: (a) Interoperations didn't work or didn't work well. "Less than stellar." (b) "Should only be used when there are not enough available operating Trailblazer systems to get fixes. Time/precedent requirements when in interop mode created 'inconsistent sets' rather than adding Quickfix LOBs to Trailblazer fixes." "Slows down Trailblazer response time too much with little appreciable effect on DF results." "DF request management should be improved so that ground operators can request more LOBs/LOPs from aircraft." (c) No real difference.
068	3.3	AIR CONDITIONER [80%]: (a) Uneven distribution of cooled air. Operator at position 2 [against back wall] was typically significantly cooler than operator at position 1, making it difficult for both operators to be comfortable at same time. "I was wearing my long underwear inside shelter in Arizona in middle of summer. The [computer] compartment that needs to be cooled should be insulated from operators." "Feet get cold while head & chest are still warm." (b) Unreliable: "Our A/C quit daily, requiring it to be reset; maintenance people couldn't fix it. It finally quit coming on [at all]. There is a problem either with unit (design) or tech manual covering repairs & troubleshooting procedures." "When it [worked], it was always too cold . . . usually 59 degrees." (c) Zipper on outside A/C cover was typically inoperable. Zipper is unnecessary; operator should be able just to roll cover to side. (d) No backup system.
089	3.2	BREAKER ACCESS PANEL DOOR [87%]: (a) "Too many screws." "Nine locking screws to do job of one latch." "Time consuming & annoying." Easy access should be provided, because "breakers inside panel often switch off when main power (S-4) is thrown." A tool should not be required. One latch would suffice. (b) Screws become stripped too easily. (c) Door should flip up on spring hinge or slide up & down. (d) Safety hazard: Should open away from shelter door. "I bumped into it & gouged my arm." "Just right height to catch your knee when open." "Is this cover even necessary? If switches weren't located in most prominent, most likely to be bumped area within shelter, then one could do without door."
116	3.2	MOPP IV PERFORMANCE <u>inside</u> shelter [100%]: (a) Generally miserable (too warm, mask gets heavy after awhile, etc.), but no extraordinary problems. (b) Most common hindrance was in typing with gloves on. Used pencils to manipulate keys. (c) Reduced visibility, especially downward; so required excessive head & neck movement to type, write, etc. (d) "If mask is worn with a hood, hearing is significantly impaired." (e) Quality of voice communications was "poor." "Very difficult to get headset's microphone into position to speak into it without pulling it away from one ear." (f) Reduces operator alertness; tend to fall asleep. (g) Problem using foot switch with MOPP boots. (h) "We adjusted nicely."

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
069	3.1	EMERGENCY LIGHT [73%]: (a) Safety hazard. Very poor location: "I hit my head on it 43 times. Move it!" "[Expletive deleted] I hit my head on that thing about 20 times." "Too low--was cause of many headaches." "Perfect position to claim scalps." "Personnel are constantly bumping heads." (b) Needs to be repositioned towards center of shelter to facilitate usefulness & to protect against head injury.
081	3.1	OPERATOR PANEL FOOT SWITCH [87%]: (a) Frequently sticks in ON position. (b) "Difficult to find; need an optional hand switch." "Requires extensive fumbling about to key radio." "Hard to activate." (c) Easy to activate accidentally. (d) Common to have radio cut off in mid sentence. (e) "Sometimes problems with shorts." (f) "Should be improved." "Should be a separate foot switch for radios & intercom/op comments." (g) Dirt & mud are its "worst enemy." (h) "Easy."
074	3.0	WRITING SURFACES [87%]: (a) Sliding shelf at position 1 is prevented from extending fully by location of TA-312 field phone, which significantly reduces usefulness of shelf. Shelf at position 2, when fully extended, tends to interfere with arm of operator 1. "Position 1 [shelf] . . . is totally useless. We used clipboards." [Surfaces are] "too small, but it's supposed to be a paper-free system (ha ha)." (b) Shelf for position 2 is very difficult to use if operator is left-handed. Writing angle is poor because chair doesn't swivel. (c) Corners of shelves are sharp; operators commonly hit their elbows.
085	3.0	SPEED OF THE COMPUTER from the user's point of view [80%]: (a) Response time is too slow. Cursor "doesn't keep up with user, especially [at] line return." (b) "Not at all in keeping with technology available or, more importantly with speed capability requirement for a system with this . . . mission. Partial seconds can be crucial--it should not take 15+ seconds to call up directory." "DF should respond very quickly & easily because mission generally depends on this function." "Too slow in giving fix." "A little slow in accessing LOB data." "Two slow when both operators access simultaneously; need more storage." (c) "Not state of art, but adequate."
073	2.9	OPERATOR CHAIRS [80%]: (a) Uncomfortable for extended use. Need to be able to swivel & to be height adjustable. Capacity to swivel "would be a big help" because writing surfaces are off to side of operator. (b) A headrest & adjustments for inclination & lumbar area would be useful, as would improved forward & backward adjustability. With chair in rear position (common operating position), little room is left behind position 1 for operator from position 2 to pass by. " Not enough leg room." (c) In rearward position,

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		position 2 chair hits NBC detector mount--problem is position of mount. (d) "Flimsy."
072	2.8	STORAGE SPACE within shelter [67%]: (a) Compartment with door needed (possibly near weapons rack) for storing manuals* (which bounce about during transit & come apart) & other items such as forms, working implements, note pads, etc. Currently available space is awkward & inconvenient. Anything placed on shelves between position 2 & wall fall out during transit. There is an ammo can strapped to floor; it served no purpose. (b) No provision for TA-50 during test. (c) Adequate.
086	2.8	RECEIVER CONTROL & DISPLAY UNIT [67%]: (a) Tuning: Toggle switch tuning inadequate. "Toggle switches must go!" "Spin dial is cornerstone of our MOS; toggle switches do not work for me." "This is 1989; I'm working with a system which performs its crucial function in a fraction of a second, & I'm tuning in frequency with toggle switches? It's a bad joke. Even worse is trying to knob tune." Toggles "should continue to change [frequency] if held down, instead of having to click for each increment." "Should have a keypad in addition to toggle switches & tuning knob. Also, tuning knob should have an adjustable tuning rate, probably most frustrating shortcoming." (b) Spectrum display: "If it ever works (ours never did), is not needed; i.e., wasted space." "Didn't help us in least, & I don't really understand why it was put in." "Utterly outmoded--can't keep up with receiver; need a better model." "No real-time tuning." "Too much delay in reaction to tuning." (c) "Does not provide for adequate manual search, nor does it provide ability to enter specific numbers in quickly." Inappropriate type of control unit--need something like improved Guardrail V." (d) "Need a NATO tone reject system to eliminate computer monitoring of friendly signals in DS mode." (e) "Okay, but hard to learn."
075	2.6	WORK SPACE (for operations or maintenance procedures) [33%]: (a) "Tight." "Too cramped." "Quickly cluttered." (b) Adequate.
092	2.5	TSEC/KG-45 [40%]: (a) "Light on KYK-13 should flash twice--sometimes it does; a lot of times it only flashes once, but system still works." "It is supposed to load after two parody lights; it would load with one; but how do you know [it's loaded] until BITE?" (b) "Need crypto with memory capacity." "It clears itself every time power is lost--why? That is unnecessary; there are two other components retaining fill so it can't be for security!" (c) Sometimes difficult to connect fill cable. "Plug in bad position. Why in middle of two cables?" (d) "Good."
083	2.4	AUDIO RECORDER FOOT SWITCH [73%]: "Not used." "Not needed."

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
091	2.4	DMU & HEAD DISK ASSEMBLIES [40%]: (a) "Unreliable." "Easy to corrupt." (b) "No problem." "Good."
071	2.3	HEADROOM [53%]: Anyone over about 5'7" cannot stand up straight. Not a major problem, because operators are seated most of time.
079	2.3	KEYBOARD FUNCTION KEYS [33%]: (a) Sometimes do not activate unless pressed firmly. Need to be more sensitive to touch. "One must usually hit it square in middle in order to get response." (c) "No problem."
094	2.3	TSEC/KY-57 [33%]: (a) Lack of finger space for connecting fill cable. (b) Mount "doesn't hold it securely, & there is no place for a second one, which would be needed if we had a 'guard receiver' [R-442A] to use." (c) "Good."
104	2.3	SEARCH RECEIVER [20%]: (a) "Useless. System is so sensitive that it advises of activity every time it picks up a change in static. What is need is a search mode which identifies signals not static. AN/TLQ-17A has an excellent search receiver." "Too sensitive." (b) "Good."
077	2.2	HEIGHT OF KEYBOARD [47%]: (a) Somewhat too high. Nice if [it were] adjustable. (b) "Good." "Happy medium." "No problems."
078	2.2	KEYBOARD TYPING KEYS [53%]: (a) "Carriage return should be larger." A number pad would "improve efficiency." Escape key should have an escape function. (b) "Good." "No problems."
090	2.2	CAUTION PANELS [33%]: (a) "Too high." (b) "Should be centrally located" or "should have one on both operator positions." (c) "Superfluous; why not just trip circuit breaker when item has a problem serious enough to be noted?"
103	2.2	CLOCK [53%]: (a) Not functional: "Usually didn't work." "Works about as well as the one in my Dad's '69 Buick." "Nice thought, but it's not accurate; must be wound & set. A small quartz clock would be extremely more dependable & accurate." "Rather difficult to wind." People used their watches instead. (b) "Good."
076	2.1	INTERCOM CONTROLS [33%]: "Adequate." "No problems." "Never used."
080	2.1	OPERATOR PANEL [40%]: (a) Reload button: "Took a very, very long time to reload." Reload seems not to work; resetting CPU is the only way. (b) Call button: "Hardly ever came on." (c) Master caution light A-59: "Was always lit when shelter got above 62 degrees." (d) "Good." "No problems."

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
084	2.1	READABILITY OF PLASMA DISPLAY [67%]: (a) Good enough. "No problems." (b) Would be helpful if "DF readout could be in larger, more readable numbers." "Sometimes hard to read; couldn't focus." "Hard to distinguish D's, 0's, & 8's. "Glare." (c) A little high for chair level. (d) Color: "Harsh." "Good." (e) "Too hard to keep clean."
087	2.1	LIGHTS SWITCH [27%]: (a) Awkward location. Too hard to reach while seated. (b) Should have option of being able to turn them on when door is open ("without wedging something into door switch to simulate door being closed").
093	2.1	TSEC/KG-84A [33%]: (a) More training needed to prevent errors. (b) Sometimes difficult to connect fill cable. (c) "No problems." "Good."
097	2.1	REPORTING LINK TRANSCEIVER [20%]: (a) Not used. (b) "Good."
098	2.1	RADIO SET CONTROLS for Data & Reporting Link Transceivers [40%]: (a) Although not normally needed, certain adjustments require a screwdriver. No tools should be required. (b) "No problems encountered." "Good."
100	2.1	TUNABLE NOTCH FILTER [20%]: (a) "Why manually tune? System should automatically tune filter & diplexer when frequency is set." (b) "Too sensitive to [the] touch." (c) "Simple."
101	2.1	TUNABLE DIPLEXER [20%]: (a) Should be tuned automatically by system. (b) "Isn't there an easier way?" (c) "Easy."
088	2.0	POWER DISTRIBUTION BOX [20%]: "Possible to accidentally turn off switch by brushing against it."
095	2.0	VOICE LINK TRANSCEIVER [27%]: "AN/VRC-12 series radios are dinosaurs, but they get job done." "No major problems here." "Good ol' 524." "Good."
096	2.0	DATA LINK TRANSCEIVER [13%]: (a) "Fastening screws loosen too easily." (b) "Good."
105	2.0	INTERCEPT RECEIVER [20%]: (a) "Headset H-161 not adjustable for head width, very uncomfortable, even painful to ears when worn for as little as two hours." (b) "Adequate." "Good."
070	1.9	LIGHTING [27%]: [See also item 133.] (a) Sufficient, adequate; but bulbs don't last long--approximately 4-5 weeks (perhaps 150 hours); a maintenance problem. (b) "Adjustable lights don't stay in position set; they will only shine in one spot unless held."

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
082	1.9	AUDIO RECORDER [80%]: (a) "Did not use." (b) "Far superior to AN/TNH-17 [AN/UNH-17?]."
099	1.9	COMMUNICATIONS MODEM [20%]: "No interaction with this equipment." "Not part of operator's waking consciousness."
102	1.9	WATTMETER forward & reverse power [27%]: (a) Would be unnecessary if system could tune itself--except to check for excessive reverse power. (b) [Inadequate training]: "No problem, but I still don't understand what it's used for." (c) "Okay." "Good."
106	n/a	WHICH, IF ANY, PARTICULAR CONTROLS OR INDICATORS DO OPERATORS OR MAINTAINERS HAVE DIFFICULTY IDENTIFYING (BECAUSE OF LOCATION, LACK OF ADEQUATE LABELING, INFREQUENCY OF USE, ETC.)? [40%] "None." But it is confusing when maintenance uses technical terms they expect us to be familiar with, but aren't.
108	n/a	FOR WHICH, IF ANY, SYSTEM CONTROLS OR PARTS IS ACCESSIBILITY FOR OPERATION OR MAINTENANCE NOT SATISFACTORY? (KNOBS, SWITCHES, CABLES, CONNECTORS, CIRCUITRY, ETC.) LIST. [40%] (a) "None." (b) Hard to reach reset button on CPU--"swivel chair would solve [problem]."
110	n/a	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? IF NOT, WHY? [93%] [Half answered yes, half no.] (a) Yes: "Especially for beginners." "For training purposes." System has "very extensive help files--a working aid would be very simple to write up & tape beside position." (b) No: Computer help file is sufficient. "In addition, when an incorrect command is entered, a complete list of commands is provided at bottom of screen." "After a while working [with] system, we know what commands to use."
111	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? (CONTROLS, INDICATORS, LIGHTS, DESIGN, TIME CONSTRAINTS, OR ANY OTHER HUMAN FACTORS, TRAINING FACTORS, SAFETY FACTORS, LACK OF APPROPRIATE SUPPORT.) [67%] (a) "Operators often forget to hit CR [carriage return] to exit initialization. INIT light should stay on until you exit. One set [remaining] in INIT [mode] screws up whole Trailblazer system." (b) "Circuit breaker activation sequence." "[Circuit breakers] should be [arranged] in order of power-up." (c) "Requirement to be in edit mode in order to enter data or make changes & [requirement] to exit edit mode before resuming operations." "Delay time when edit function key is used--[delay] causes operators to press edit button again instead of waiting, which cancels command requested when button/key was pressed first time." "Operators neglect to get out of edit & wonder why system [e.g., GS plan] isn't working."

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		(d) Absence of "checklists (like on aircraft). (e) "Urgency of mission may make operators careless." (f) "None."
112	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF DEPLOYING THE TRAILBLAZER SYSTEM? [87%] (a) Deploying & stowing power cable: "heavy, awkward"; "two man operation." (b) Trailer support unit hookup: "Reconnecting track to TSU (backing it up to trailer)." "Getting lunette lined up with trailer hitch." Required very experienced driver. (c) Setup & tear down: Time consuming to drive ground rods & erect & extend mast. "Shroud cover handle not releasing cover properly or easily. Accessibility of whip antenna mounts & tie downs. Position of dipoles crank & locking pin, & lack of anything solid on which to stand. Brush guard release & handle. Operating TSU legs after collecting road dust." (d) "Maneuvering track along narrow, steep or rutted roads (top heavy, sways a lot)." Track is heavy & slow: "Can't keep up with any unit." (e) "Size/noise--not readily hideable. Camouflage is a major exercise. (f) Operational: "Adjusting initialization parameters when changing master stations." "CPU boot up." "Switches & KYK-13." "Sitting."
113	n/a	ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [73%] (a) None. (b) Trailer support unit: "Prone to flat tires in rocky terrain." "Fire extinguisher falls off." "Storage box doors & engine access doors do not remain closed." (c) Weight, "strain on carrier." (d) "Data link antenna elements break off." (e) "Power cable collects mud." (f) Rear step gets damaged when making sharp turns with TSU connected.
114	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF OPERATING THE TRAILBLAZER SYSTEM? [87%] (a) "Setup & tear down; camouflage." (b) "Collective protection equipment; ground rod driver." "Climbing around on top of shelter in order to deploy all antennas, & connection/removal of main power cable." (c) "Being uncomfortable in chair." "Working in such a small, uncomfortable area." "Being cold & hot at same time--cold feet, warm upper body & head." "Headsets (H-161D/U) hurt ears & head with prolonged use." (d) "Remembering all functions." "Remembering to have all switches in right positions." "Trying to use RCDU for intercept/search operations." "Getting everyone netted in a timely manner." (e) "Troubleshooting, not knowing what to do when something goes wrong." (f) "Occasional lack of teamwork." (g) "Nothing."
117	n/a	WHAT SOFTWARE CHANGES WOULD YOU LIKE TO SEE? [60%] (a) "DS PLAN: ability to activate only specific frequencies, but still have others listed; preset frequencies that can be quickly scanned; not just one 'saved' frequency. EDIT: Get rid of edit mode; make changes by typing in changes with command but not having to 'go to' edit mode

TABLE B-4. (U) OPERATOR COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
		first. GIST & SCRATCH PAD: Like to see a command available to take you straight from text entry to command mode; i.e., [with] TEXT prompt displayed, enter [some sort of] return-to-command-mode command. Help function should be within each mode & not a unique selection, i.e., if operator is in a particular mode & needs help, operator enters command for help, & options at present point of operation are given, leaving system in that mode. This is as opposed to exiting mode operator is working with, accessing help file & researching area in question, then returning to desired mode & starting over; similar to what is now available with message help feature. Need ability to select a specific page, not just first or last or having to page through to desired page. This is pertinent to directory & system status primarily, but also GS ACT, & anywhere else where multiple (more than four) pages are likely to be found." (b) "Need much more flexible gist functions." (c) DF files should be set up so that operator can designate files by frequency, [as it is] done in Guardrail & Quickfix. This would allow for more than one file on a specific frequency [and] allow more threat emitters to be located; [would] also make it easier to determine movement of same." (d) "LOB verification--if an erratic LOB is submitted during system operation, it should be thrown out automatically so that a fix is provided." (e) "Expand maximum number of fixes computer will hold from 10 to about 200. Often you need to check on a fix that came [in] five or six hours earlier & is not there." (f) "Message formatting, [which was trained but not tested], was very unwieldy & time consuming; editing & corrections are very hard to accomplish. (g) Miscellaneous: "More speed, user friendliness." "A workable escape key." "A trouble-shooting help page." "A turbo mouse (or joystick) would be quicker."

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TABLE B-5. (U) OPERATOR RATINGS & COMMENTS: SAFETY AND HEALTH HAZARDS

No.	Rtg	Topic [% responding with comments]: Gist of comments
119	3.7	NOISE LEVELS [80%]: (a) Generators (especially 60 kW) & track are too loud. Noise hazard exists for operator deploying antennas during on-board generator operations. (b) "Very bad." "Carrier is extremely loud--hearing protection a definite must." A danger both to hearing & security of personnel & system. (c) Noise level inside shelter is high with on-board generator in use. *Without headset on, is loud even without on-board generator running. "High pitched tones inside."
122	3.7	CLIMBING SURFACES [87%]: [See also items 42, 43, 128, & 129.] (a) Serious shortage of handholds, steps, on sides, top, & back of shelter. (b) Inadequate footing in places where operator must normally perform tasks, e.g., for antenna shroud tasks, dipole & whip antenna deployment, checking hydraulic fluid dipstick & air tank. (c) Slippery when wet.
130	3.7	SHELTER FOOTSTEP [93%]: [See also item 43.] (a) Footstep gets in way of TSU tongue when turning, causing significant damage to step: connecting bolts break, structure bends, causing step to slope dangerously downward (a potential safety hazard). "Needs R&D attention." (b) "Too high for short people." "Need additional step." "Should be replaced with a ladder that can be stowed under shelter." (c) "Okay."
134	3.7	GROUND ROD DRIVER [73%]: [See also item 33.] (a) "Dangerous, unstable on hard ground." "Worked only if someone stood on it." (b) Unsafe handle. (c) "Too many moving parts." (d) "Adequate." (e) "Not used."
137	3.6	WALKING & CLIMBING ON VEHICLE OR SHELTER SURFACES [80%]: (a) "No designated places to walk or stand." "Very little foot space, easy to lose balance." "Slick surfaces." "Numerous trip hazards," especially at night. "Very dangerous in MOPP gear; passable under normal circumstances." "Extreme care necessary installing & removing whip antennas in MOPP or darkness." (b) "Nothing to hang on to." "Lack of adequate hand/footholds." "Needs built-in ladders." (c) "Sharp surfaces to catch clothing on." (d) Operators sometimes step on things that get damaged [e.g., connecter for ground rod driver, located at box on deck behind cab].
128	3.4	HANDHOLDS [60%]: [See also items 42 & 122.] "What handholds?" Need more on top, around edges, sides; "safety hazard."
121	3.3	HEAD CLEARANCE [73%]: Soldiers over 5'8" cannot stand up in shelter. Emergency light is most significant safety hazard. [See comments for item 6.]
129	3.3	FOOTHOLDS [53%]: [See also items 43 & 122.] "More needed." Available footholds are too high. "Not deep enough." "Small."

TABLE B-5. (U) OPERATOR RATINGS & COMMENTS: SAFETY AND HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
123	3.1	HOT OBJECTS [80%]: (a) Vehicle engine exhaust pipe poses a significant hazard to operators who must climb up (without appropriate handholds) & work in vicinity. "I've burned myself on it accidentally." "Only an idiot grabs a muffler." When it blows on shelter (front curbside), shelter surfaces may become hot (e.g. antenna control box). (b) While engine exhaust pipe is partially shielded, personnel heater exhaust is completely exposed. (c) All dark surfaces become very hot when exposed to sun on a hot day. (d) [See items 44 & 45.]
131	3.0	SHARP OR POINTED OBJECTS [40%]: (a) Wire mesh at ends of power cable. (b) Chains that hold dust caps on power cable [see also item 40]. (c) Ground cable on TSU [see also item 135]. (d) Operator tore BDU on exhaust pipe. (e) "No problems."
139	2.8	OVERALL SAFETY OF TRAILBLAZER SYSTEM for operating or maintaining? [27%]: (a) Safe only when caution is emphasized in training. (b) Height of track puts operators at some peril. (c) No "unreasonable" problems if system used properly.
120	2.7	CARBON MONOXIDE LEVELS [60%]: (a) "Sometimes I could smell exhaust fumes inside shelter with door shut." "TSU exhaust will be blown according to wind direction--a good reason to keep shelter door closed when operating." (b) "Constant [exposure] during deployment, setup, & when outside during operation. "Should perhaps be a consideration during setup; however, not mentioned during training." Exhaust sometimes blows into track's crew cab. (c) "Must be careful of where TSU is parked; however, wind changes can bring exhaust into shelter." "Proper site layout minimizes this concern."
127	2.7	RF ENERGY [40%]: (a) "Data link pulse is unsafe for survivability." (b) Training did not adequately warn operators about staying away from RT-524 whip antenna when operational. (c) "No problems."
132	2.5	GLARE [27%]: (a) "When driving carrier in anything but ideal conditions, visibility is poor. I found myself putting my head out window in order to see better, & at times opening door. Particularly bad at night." (b) "No problems."
125	2.4	MOVING MACHINERY [33%]: (a) Need mirrors by driver's door. (b) "I have often wondered if a hydraulic failure would cause mast to crush someone." (c) "Track & TSU have enormous potential for causing death or serious injury." (d) "No problems."
124	2.3	CREW SEAT BELTS [33%]: [See also item 136.] (a) "Didn't use." "What crew seat belts?" (b) "Adequate." "Good."

TABLE B-5. (U) OPERATOR RATINGS & COMMENTS: SAFETY AND HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
126	2.3	ELECTRICAL SHOCK HAZARDS [27%]: (a) "Potential for electrical shock is omnipresent. A tired, overworked soldier could make a careless, fatal error." "Minimal [hazard] if proper procedures are followed (grounding, etc.)" (b) "No problems."
135	2.3	GROUNDING CONNECTIONS [33%]: [See also item 131.] (a) "TSU ground cable came with a bare wire end; tough to deal with & painful to get stabbed by." (b) "Need clamps on each cable end." (c) "Okay." "Good."
136	2.1	SEAT BELTS [27%]: [See also item 126.] (a) "What seat belts?" (b) "Didn't use." (c) "Good."
138	2.1	SAFETY COVERAGE IN OPERATOR'S & MAINTENANCE MANUALS (warnings, cautions etc. [20%]: "Adequate."
133	1.9	LIGHTING ADEQUACY. [40%]: [See also item 70.] Adequate when lights work--"spare bulbs should be provided in shelter."
140	n/a	WHAT PROBLEMS REGARDING SAFETY OR HEALTH HAZARDS SHOULD BE ADDRESSED IN THE OPERATOR'S (OR MAINTENANCE) MANUAL BUT ARE NOT? [47%] (a) "Climbing on vehicle & shelter while in MOPP IV." (b) "Carbon monoxide inside shelter." (c) Danger of falling off side of track because of weak brush guard release handle, which is prone to breaking off in operator's or maintainer's hand. (d) "None. People don't learn safety from TM's. Most safety problems on Trailblazer result in annoying bruises, pinched fingers, twisted ankles, etc. Mostly minor stuff." (e) "I never really looked at operator's manual except when learning commands in training."

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Maintainer Comments & Ratings on Maintenance Training & Manuals, Safety & Health, & Human Factors

TABLE B-6. (U) MAINTAINER RATINGS & COMMENTS: MAINTENANCE MANUAL (-20)

No.	Rtg	Topic [% responding with comments]: Gist of comments
013	3.8	ACCURACY [100%]: [See also items 009, 015, & 24.] "Many of flow charts, wiring diagrams, & test jacks were mislabeled." "Accuracy of -20 manual OK, but -30 manual has many omissions on foldouts." Errors exist in specifications for cable connections & jack numbers.
002	3.5	DURABILITY [75%]: (a) Needs to be more durable, especially for field use. "Very fragile." "Pages are always falling out." (b) "A lot of needless information in beginning of manual."
009	3.5	COMPLETENESS [75%]: (a) No maintenance information (wiring diagrams, etc.) is included for antenna system. (b) Many cable numbers in manual do not corresponds to actual numbers on cables. Many jack & pin numbers are also incorrect or not listed.
015	3.0	EASE OF USE as a reference document during operations or maintenance [25%]: "Cable numbers, jack numbers, etc. are unreliable."
003	2.8	QUALITY OF REPRODUCTION [50%]: (a) Many illustrations blurred & illegible [see also item 011]. (b) Some mistakes found in diagrams.
010	2.8	APPROPRIATENESS OF CONTENTS [75%]: "Poor, for first two sections. "Material in beginning of book was useless." "A lot of needless information in beginning of manual."
011	2.5	ILLUSTRATIONS [50%]: [See also item 003.] "Many illustrations are too small, [like] illustrating needle in haystack by showing us whole farm!" Inaccurate & poorly reproduced.
014	2.2	EASE OF USE as initial training document [25%]: Better than a study guide.

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TABLE B-7. (U) MAINTAINER RATINGS & COMMENTS: TRAILBLAZER TRAINING

No.	Rtg	Topic [% responding with comments]: Gist of comments
021	3.5	TRAINING PROCEDURES [100%]: [See also item 024.] (a) "Very poor--wasted time." "Less time needs to be spent on operational procedures. It should have taken only 12 hours [vs. 32] to train 3-man teams on operations." (b) Inadequate training on trouble-shooting: Lack of available spare line replaceable units, replacement cards, etc. precluded practicing trouble-shooting with realistic bugs. More hands-on training of trouble-shooting needed. (c) Instructors should be knowledgeable on system.
024	3.5	Use of TRAINING TIME [100%]: [See also item 021.] (a) "There was too much waiting time, & course is too long." "A lot of wasted time could have been used for training on antenna." (b) "Training could be improved if accuracy of materials . . . were improved!!! We spent (no lie) at least 20% of our training time correcting diagrams, flow charts, etc."
018	3.3	Training for SYSTEM MAINTENANCE [100%]: (a) Training incomplete: Very little or no training on antenna system, interoperations, or on tracing signals from shelter bulkhead to outside equipment. (b) No manuals available for training on M1015A or TSU. (c) "Teaching schedule inefficient."
020	2.8	TRAINING MATERIALS, AIDS, & EQUIPMENT [50%]: (a) "Student handbooks & overhead slides redundant--it was almost all in 10 & 20 manuals." (b) "Need hands on for antenna."
022	n/a	WHICH TOPICS OF INSTRUCTION OR CRITICAL TASKS WERE MOST DIFFICULT FOR YOU OR THE OTHER STUDENTS TO LEARN? WHY? HOW COULD THEY BE TAUGHT MORE EFFECTIVELY? [75%]: (a) None were difficult; all elementary. (b) "Start-up procedure. It changed several times before one procedure was established."
023	n/a	FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME WITHOUT ASSISTANCE? [50%]: [The mean response to this question, based on estimates of all four maintainers was 76%; the range was 50 to 95%.] (a) Not enough experience after training to achieve high percentage. (b) "Information was all in manuals, but some people don't want to use manual."
025	n/a	WHAT WAS THE MOST SERIOUS SHORTCOMING, IF ANY, ASSOCIATED WITH YOUR TRAILBLAZER TRAINING? WHY? [100%]: (a) "No antenna training." (b) Manuals: "Trainers did a great job of doing their best with what they had to work with. Had it not been for trainers showing us mistakes in the manuals [the manuals would have been] more valuable as potty-training papers for your dog!!!" (c) Couldn't maintain interest, because it was so dragged out.

TABLE B-7. (U) MAINTAINER RATINGS & COMMENTS: TRAILBLAZER TRAINING (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
026	n/a	ARE THERE SOME GOOD TECHNIQUES YOU COULD SUGGEST FOR TRAILBLAZER TRAINING THAT WERE NOT USED? [50%]: (a) Include "antenna bugs by disconnecting RF cable at dipole or loosening ground at hockey pucks. This is a very common failure that was never mentioned during training." (b) Make quizzes "more realistic"--"instead of quizzes on where stuff is in manual."
027	n/a	WERE ANY ESPECIALLY GOOD TECHNIQUES USED THAT SHOULD BE RETAINED IN FUTURE TRAILBLAZER TRAINING? [50%]: (a) "Practical trouble-shooting." (b) "Hands-on."
029	n/a	DO YOU HAVE ANY OTHER COMMENTS OR SUGGESTIONS REGARDING TRAINING? WHAT WOULD YOU CHANGE IF COST WERE NOT A FACTOR? [100%]: (a) Get "knowledgeable instructors." "Throw out student handbooks; use time for reading manuals instead of listening to mumbling instructor's lectures." (b) More realism: Although during training actual repairs can be made only by bona fide maintainers [here, contractors], use opportunity to "let students isolate faults that occur." Provide "more line replaceable units to [allow] more realistic faults during trouble-shooting." (c) Provide more training on antenna. (d) Ensure that "printed materials (schematics, block diagrams, etc.)" are correct; need great improvement. (d) Accelerate course.

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TABLE B-8. (U) MAINTAINER RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
053	4.2	DATA LINK ANTENNA ELEMENTS [100%]: "Metal . . . seems too soft. Many threads are stripped, & many times elements unscrew themselves or are broken off [because of] shaking of shelter in transport & lack of antenna clearance when stowed" [see also item 052]. "Screw-in type are too rigid & easily broken."
049	4.0	BRUSH GUARD RELEASE [100%]: (a) Easily broken off [safety hazard]. Needs to be metal rather than plastic. (b) "Doesn't hold in open position." (c) Hard to find replacements.
066	4.0	CPE (collective protection equipment) [100%]: (a) Too heavy. Mounts of aluminum alloy will break easily. "Seal does not work at all." "Junk; haven't seen one work yet." (b) No maintenance training on this equipment was provided.
067	4.0	MOPP IV PERFORMANCE outside shelter [50%]: (a) Safety hazard: "Safety atop shelter would be my biggest concern. MOPP gear is in no way streamlined for monkeying around 10 feet off ground." (b) "Repairs to any equipment in EMI would be impossible; it is very difficult to disconnect cables [even] with bare hands because of cramped area, & gloves wouldn't fit."
036	3.8	60 KW GENERATOR & ITS CONTROLS [100%]: (a) "Not able to run for any length of time in case of TSU failure." (b) "Unreliable & dangerous to operate." (c) "It is blamed for crashing hard discs." (d) "Junk, too many problems."
048	3.8	ANTENNA SHROUD LATCH [100%]: (a) "Poor design." "Too fragile." "Easily broken." "Mechanically insufficient." "Springs & mechanism over stressed." Replaced 10 latches in three months. (b) Should have instruction label to show proper direction for operation: Operators tended to turn it in wrong direction & then complain that it didn't work.
052	3.8	ANTENNA GROUP CLEARANCES when deploying or stowing [100%]: [See also item 053.] (a) "Lack of clearance usually causes data link elements, dipoles, & RF processor, MFC, etc. to be unnecessarily damaged." "Antenna is too bulky & will sag after continued use [because of] weight of intercept group." (b) "Closing shroud cover shears off retaining screws on EMI." (c) [On one system], "shroud latch will not catch at all because cover can't close." "Does not completely stow."
037	3.5	NOISE LEVELS [100%]: (a) "Entirely too loud." "Very noisy." "Too noisy too work on outside." "Not enough adequate hearing protection provided." (b) "Enemy will have NO PROBLEM locating us!"

TABLE B-8. (U) MAINTAINER RATINGS & COMMENTS: HUMAN FACTORS--OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
041	3.5	TAILGATE [75%]: (a) Difficult to perform maintenance functions with TSU connected to carrier. "Tailgates should all be hinged on the right, so shelter can be accessed without dropping TSU. The set with reversed tailgate experienced delays in nonessential maintenance because it was not efficient to drop TSU for a minor repair." (b) "Hard to lubricate." (c) "Temperamental."
044	3.5	EXHAUST PIPE, ENGINE [75%]: (a) Burn hazard to operators climbing onto shelter & when standing on deck behind cab to raise antenna. (b) "Too close to passenger in cab." (c) "Messy" [because of soot].
047	3.5	MAST TRANSPORT RETAINING FASTENER [50%]: (a) "Too hard to move." "Easily misaligned." "Bends when [struck] with TSU mega wrench in effort to open or close it." (b) "Hard to find replacement parts."
064	3.5	M1015A TRACK VEHICLE (Suitability for Trailblazer?) [75%]: "In hilly terrain, M1015A is nearly defeated. Trailblazer system is too heavy for a M1015A." "M1015A is not a suitable vehicle . . . . too high . . . & ride & stability are not good enough for security of sensitive equipment." "Piece of [expletive deleted]."
065	3.5	STEERING THE M1015A TRACK VEHICLE [25%]: "Even tension on laterals is a problem."
033	3.3	GROUND ROD DRIVER [75%]: (a) "Junk, never works." "Seems to work well only after a torrential downpour in soft ground or sand. I think it is an unnecessary luxury." (b) "Not used."
034	3.3	GROUNDING STRAPS/CABLES/CLAMPS [100%]: (a) Ground connections should employ large alligator clamps (some were missing & none were available as replacements until well into test. (b) No spare cables for ground rod.
050	3.2	CRANK HANDLE FOR ANTENNA GROUP including shear pin [75%]: (a) "Does not allow for stress of continued use." "Antenna is too heavy" [for it]. (b) A label that shows proper direction of rotation "would help save wear & tear on gears" because handle cranks in direction opposite to expectations.
042	3.0	HANDHOLDS for climbing onto shelter [75%]: (a) "When in MOPP gear, hand/footholds need to be much larger!" (b) "Shelter handhold on curb side toward front of shelter would help because tie down (which is all there is to grab) is right by exhaust pipe." "Need some."
043	3.0	FOOTSTEP for entering & leaving shelter [75%]: (a) Bent, broken, not securely attached. (b) High off ground for soldiers of shorter stature--"Couldn't there be a second step a little lower?"

TABLE B-8. (U) MAINTAINER RATINGS & COMMENTS: HUMAN FACTORS--
OUTSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
051	3.0	CRANK HANDLE FOR DIPOLE ELEMENTS [25%]: As for antenna group crank, proper direction of rotation for deploying & stowing is not obvious. A label would help.
056	3.0	ANTENNA HEIGHT LIMITER [25%]: "No real purpose."
061	3.0	MAST HYDRAULICS [50%]: (a) "Somewhat slow in operation." (b) "Insulating cover insecure. If it is considered necessary, it should be cut to fit metal lid only & be permanently affixed."
045	2.8	EXHAUST PIPE, HEATER [25%]: "In the way when erecting antenna."
054	2.8	QUICK-RELEASE PINS [50%]: "Retaining cables connecting pins are too fragile, & pins get lost."
031	2.7	TSU [25%]: Too many TSU failures because of problems with fuel lines & fuel filters.
039	2.5	POWER CABLE INSTALLATION [25%]: "Hard to get too & difficult to connect unassisted."
046	2.5	WHIP ANTENNAS [25%]: Voice antenna should be left installed & tied down during transport because protective caps for base get broken or lost, & engine exhaust then coats contacts with soot.
057	2.5	MAST CONTROL BOX COVER [25%]: "Slips off hinges."
060	2.5	ANTENNA LEVEL [25%]: "Takes two people. Put box on back of shelter."
063	2.5	MAST PNEUMATICS [50%]: (a) "Seals on mast can be easily damaged [from] impact on collars during extension & collapse. In some cases this has been known to cause antenna to missile." (b) "When power is lost, antenna drops."
035	2.2	30 KW GENERATOR & ITS CONTROLS [25%]: "Not impressive, but when it works, it seems sufficient."
058	2.2	MAST CONTROL BOX SWITCHES [25%]: "No training at all on controls & indicators for mast."

TABLE B-9. (U) MAINTAINER COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER

No.	Rtg	Topic [% responding with comments]: Gist of comments
069	3.5	EMERGENCY LIGHT [75%]: (a) "Lights burned out too easily." "Bulbs blow at blink of an eye!" (b) "Poor location."
089	3.5	BREAKER ACCESS PANEL DOOR [100%]: (a) "Too many screws, & it pops out when last screw is released." Needs clamp or velcro instead of screws. Screwdrivers are easily lost & screws are time consuming. (b) Top hinge preferred to side hinge. Training needs to emphasize that it is easy to get caught on door if it is not kept closed.
073	3.2	OPERATOR CHAIRS [75%]: (a) Chairs are too large to allow maintainers to perform certain functions without removing them; they are difficult to move.
072	3.0	STORAGE SPACE within shelter [75%]: "Insufficient." There should be storage space for "headsets, handsets, manuals, etc. during transportation."
075	3.0	WORK SPACE (for operations or maintenance procedures) [50%]: "Many jacks, screws, etc. are difficult to reach!" "Poor work space for maintenance."
076	3.0	INTERCOM CONTROLS [50%]: (a) "Bleed through of voice link onto other selections." (b) "Half of them aren't used."
091	3.0	DMU & HEAD DISK ASSEMBLIES [100%]: Unreliable. "Need some way to reprogram disk in unit."
086	2.8	RECEIVER CONTROL & DISPLAY UNIT [50%]: (a) It was not a beneficial component: "It seemed to have poor response to signal." It was ignored to point that it was not a maintenance problem. (b) Unit should have a keypad for entering frequencies.
088	2.8	POWER DISTRIBUTION BOX [50%]: (a) "Blocks door when working on it." (b) "Two of five elapsed time meters failed, which seems excessive for something with no wear or tear."
107	2.8	LABELING OF SYSTEM COMPONENTS [50%]: (a) "All cables on line replaceable units are hard to see because of their location, lack of space, & lack of lighting." (b) Operator panel not labelled "A45".
068	2.5	AIR CONDITIONER [75%]: [See also item 126.] (a) "Ineffective filters. Main vent opening has none at all." (b) "Seems to be adequate, but mysteriously runs out of freon frequently." (c) "A/C cover poorly designed; zipper breaks; doesn't need zipper in first place. Pocket design collects water & funnels it in through A/C vents; it pours onto shelter floor, which is a safety hazard. If pouch is necessary, it should have a drain hole in bottom." Cover is attached with snaps "which are much harder to manipulate than turnbuckles would be."

TABLE B-9. (U) MAINTAINER COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
070	2.5	LIGHTING [50%]: [See also item 107.] (a) "Bulbs blow too frequently"; otherwise, fine. (b) "Poor."
071	2.5	HEADROOM [50%]: Poor for taller operators.
085	2.5	SPEED OF THE COMPUTER from user's point of view [75%]: Slow. "Why Trailblazer logo?--wastes time."
099	2.5	COMMUNICATIONS MODEM [25%]: "No room to get cables on & off."
103	2.5	CLOCK [25%]: "Junk."
109	2.5	EASE OF TRANSPORTING SYSTEM COMPONENTS [50%]: (a) "RF processor is a pain to replace hanging off shelter." (b) "No problems."
074	2.2	WRITING SURFACES [25%]: "Trays stick when pulling them out." "Not "much space."
081	2.2	OPERATOR PANEL FOOT SWITCH [25%]: "Hard to get at."
087	2.2	LIGHTS SWITCH [25%]: "Bad location."
090	2.2	CAUTION PANELS [25%]: "Need to be larger so operator will see it when a fault occurs."
094	2.2	TSEC/KY-57 [25%]: "No finger space."
095	2.2	VOICE LINK TRANSCEIVER [25%]: "RT-524 is junk. Not reliable."
082	2.0	AUDIO RECORDER [50%]: Not used.
092	2.0	TSEC/KG-45 [25%]: "Finger space is 'iffy.'"
106	n/a	WHICH, IF ANY, PARTICULAR CONTROLS OR INDICATORS DO OPERATORS OR MAINTAINERS HAVE DIFFICULTY IDENTIFYING (BECAUSE OF LOCATION, LACK OF ADEQUATE LABELING, INFREQUENCY OF USE, ETC.)? [25%] "Operator control panel is not labeled as such."
108	n/a	FOR WHICH, IF ANY, SYSTEM CONTROLS OR PARTS IS ACCESSIBILITY FOR OPERATION OR MAINTENANCE NOT SATISFACTORY? (KNOBS, SWITCHES, CABLES, CONNECTORS, CIRCUITRY, ETC.) LIST. [100%] (a) "Cables & connectors for signal data processor & receiver enclosure units." "DF receiver & all its cables & controls are hard to get to." "Cables on plasma, CPU, I/O chassis, RF processor, & others are difficult to hook-up & unhook because of lack of finger space." "RF cables, communications modem, RF processor." "A45, which is not labeled but is the part around plasma [scope]." (b) "All."

TABLE B-9. (U) MAINTAINER COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
110	n/a	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? IN NOT, WHY? [75%] (a) "[No], that's why you have a 10 manual." "[No], computer can more readily find that information through 'Help' command." (b) "Yes, probably."
111	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? (CONTROLS, INDICATORS, LIGHTS, DESIGN, TIME CONSTRAINTS, OR ANY OTHER HUMAN FACTORS, TRAINING FACTORS, SAFETY FACTORS, LACK OF APPROPRIATE SUPPORT.) [75%] (a) "Operator manuals do not relay proper sequence for power-up on power distribution panel. Suggest reconfiguring circuit breakers in order of power-up to prevent writing over information on data disk, [which causes system] failure. Or rewrite manual to include proper procedure." "Circuit breaker 31 needs a special switch to remind operators to turn it on last--[like] battleshort retaining bar. (b) "Improper initialization; e.g., in 'local' instead of 'auto' mode."
112	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF DEPLOYING THE TRAILBLAZER SYSTEM? [75%] (a) "Climbing on shelter to erect antenna." (b) "Driving damn ground rod into a rocky terrain!" (c) "Moving mast travel bar."
113	n/a	ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [75%] (a) "Data link antenna elements break." "Antenna bounces around." (b) "No."
115	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF MAINTAINING THE TRAILBLAZER SYSTEM? [100%] (a) "Inaccessibility--very little work space for antenna without danger of falling." "No room." (b) "[Lack of] lighting." (c) "Replacing data link elements & re-tapping threads on antenna for elements." (d) "Antenna sags after repeated usage--as much as 18 inches!!!" (e) "Trying to work on a set while others are performing a mission."
117	n/a	WHAT SOFTWARE CHANGES WOULD YOU LIKE TO SEE? [75%] (a) "A quicker initialization program." (b) "Better BITE routine." (c) "None."

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TABLE B-10. (U) MAINTAINER RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS

No.	Rtg	Topic [% responding with comments]: Gist of comments
130	3.7	SHELTER FOOTSTEP [50%]: [See also item 43.] (a) "Gets hit [by trailer tongue] & bent." (b) "Too much distance between ground & footstep, & footstep & shelter."
119	3.5	NOISE LEVELS [75%]: "Very noisy." "Unsafe outside shelter, especially when using 60 kW." "Need to ensure use of adequate hearing protection at all times."
123	3.2	HOT OBJECTS [100%]: (a) "Exhaust & heat pipes are too close to climbing areas & can be grabbed by accident." (b) "Just need to pay attention."
128	3.2	HANDHOLDS [75%]: [See also items 42 & 122.] (a) "Too small." (b) Need more along side to work on antenna." (c) Need "something at curbside forward corner away from [exhaust] stack."
125	3.0	MOVING MACHINERY [50%]: (a) Moderate safety hazard involved in hooking up TSU. (b) It is quite unsafe to "manually [depress] brush guard release & [pull] antenna over your head."
137	3.0	WALKING & CLIMBING ON VEHICLE OR SHELTER SURFACES [75%]: [See also items 122 & 128.] (a) "[Footing] is very unstable [because of] cables & winch bar [used] for shelter stability." "Dangerous; not enough room to walk safely [because of] cables & come-alongs for anchoring shelter." "No place to step on antenna side"; there is a cable on side where operator must step.
121	2.8	HEAD CLEARANCE [50%]: (a) Emergency light constitutes a moderate hazard. (b) "Very 'iffy.'"
122	2.8	CLIMBING SURFACES [50%]: [See also items 128 & 137.] Inadequate. "Foot/handholds too small."
126	2.8	ELECTRICAL SHOCK HAZARDS [50%]: [See also item 068.] "Design of A/C cover is such that when it rains, cover acts as a funnel for water to be channelled into shelter by way of A/C vents. On many occasions, after a rain, inside of shelters were one & a half to three inches deep in water! This makes power-up VERY unsafe!" Substantial hazard when there is "water on floor from air conditioning funnel."
134	2.8	GROUND ROD DRIVER [75%]: "It's safe because it never works." "Nearly useless." "Didn't use."
129	2.7	FOOTHOLDS [25%]: "Too small."
135	2.7	GROUNDING CONNECTIONS [25%]: "Larger cable clamps like used for jumping batteries would be easier to use & sturdier."

TABLE B-10. (U) MAINTAINER RATINGS & COMMENTS: SAFETY & HEALTH HAZARDS (Continued)

No.	Rtg	Topic [% responding with comments]: Gist of comments
127	2.5	RF ENERGY [25%]: It is moderately unsafe while "one operator is setting up his voice link & data link while another is on top of shelter deploying antenna" [risks RF burn from voice link antenna].
133	2.5	LIGHTING ADEQUACY [25%]: "Need more light." [Need] "more dependable maintenance light."

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Trailblazer Questionnaire for Instructor Personnel

24 May 1989

MEMORANDUM TO: Instructor Personnel (New Equipment Training, Trailblazer test)

FROM: Dr. Richard L. Palmer
U.S. Army Research Institute
HQ TEXCOM (PERI-SH)
Fort Hood, Texas 76544-5065

SUBJECT: Trailblazer Questionnaire for Instructor Personnel (Topics: human factors and related issues: -10 and -20 manuals, operator and maintenance training, man-machine interface, and safety hazards.)

1. The information you provide on the attached questionnaire will be used for research and development purposes only, and will be treated confidentially. Therefore, you need not put your name on the form.

2. Please provide your response as soon as possible. You may forward your completed questionnaire to me at the address above. After May 25th, I may be reached for discussion at AV 738-9222 (commercial 817/288-9222).

3. Be assured that the purpose for obtaining the information you provide is not to evaluate the trainers or students of the classes conducted for the Trailblazer test. On the contrary, the purpose of the questionnaire is to provide information that will be of use to the Army in further developments of the Trailblazer system and the training associated with it. I am not interested in comments about the current training in particular unless those comments apply to Trailblazer training in general.

4. The information obtained with this questionnaire will be analyzed and provided to the TEXCOM INSBD Test Directorate to assist them in answering the training, human factors, and safety issues in the Test Design Plan. It is anticipated that the information will become part of the Trailblazer IOTE test report and subsequently published as a separate research report by the U.S. Army Research Institute.

5. You contribution is much appreciated, and I apologize for the length of the questionnaire--but there are many topics about which you may be able to provide valuable insight.

Richard L. Palmer
Research Psychologist

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INSTRUCTIONS: The questions and lists that follow are meant to be suggestions only. You need not limit your remarks to the topics provided. Feel free to address any related topics you wish. You may skip items for which you have no constructive comments. You may attach extra sheets of paper or write on the back of the pages if you desire to expand on any of your responses. Be accurate and complete, but as brief as possible. If you can, provide details, examples, numbers--i.e., hard stuff!

As you make your comments, try to take into consideration your past experience with the system as well as the training for the Fort Huachuca test--past training, exercises, deployments, etc.

Please glance through the entire questionnaire before you start to answer. Some topics are related to others.

Important Note! On many of the items, you are asked to rate the topic on a 5-point scale, where 1 is the best rating and 5 is the worst. Please choose one response only, and if you rate the item 3, 4, or 5, please explain why so that the problem will be clear. Also, please do not rate items where your knowledge or experience may be limited, or for any other reason you may have limited confidence in the rating you would assign.

****

Section 1: Your Function in the Trailblazer Test

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01. Which was your area of work during the Trailblazer training at Fort Huachuca?

[ ] Operator training
[ ] Maintenance training
[ ] Other (Specify: _____)

(Note: In the questions that follow, unless you note otherwise, it will be assumed that your responses generally pertain to the area you check here.)

Section 2: The -10 Operator's Manual and the -20 Maintenance Manual

---

The following questions deal with the -10 and -20 manuals. Please provide your suggestions about how the manual (whichever pertains to you) could be improved in any of these or other areas.

01. PHYSICAL SIZE of the manual. (Too large? Too small? Too thick? What would be the ideal? Why?)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

02. DURABILITY as a field document. (Will it hold up?)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

03. QUALITY OF REPRODUCTION. (Crispness of print? Readability? Etc.)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

04. TABLES OF CONTENTS. (Completeness? Locations? Helpfulness?)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

05. INDEX. (How easily can the student, operator, or maintainer find the desired information, using the index?)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

06. READING LEVEL. (Too hard? Too elementary?)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

07. LOGICAL FLOW OF MATERIAL throughout manual (within sections and across sections). (Are things in the right places?)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

08. FORMAT. (Easy on the eyes? Headings that stand out? Size of paragraphs? Length of sentences? Arrangement of material on pages? Margins? Size of type? Style of type? Illustrations in the right place? Easy to pick out relevant material from page?)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

09. COMPLETENESS. (What needs to be there, but isn't? Are any important warnings, cautions, notes, or technical materials missing?)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

10. APPROPRIATENESS OF CONTENTS from the user's point of view. (What is included that does not need to be there?)

Circle one: Very good Good Fair Poor Very poor

1 2 3 4 5

Your comments or suggestions:

11. ILLUSTRATIONS. (Enough? Too many? Clarity? Size? Location? Etc.)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

12. COMMAND SUMMARY. (Clear to student? Easy to use?)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

13. MISTAKES. (If you know of mistakes of any kind in the manual, please list them here by page number. What is the error? How it could be corrected?)

Your comments or suggestion

14. EASE OF USE by students as a TRAINING document.

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

15. EASE OF USE by operators or maintainers as a REFERENCE document.

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

Section 3: Training

---

16. Was the Army course training package provided you complete and accurate in regard to (a) system employment, (b) system operation, and (c) system maintenance? (This includes training documentation--such as manuals for the M1015, the 30 kw generator, the TSU, etc.--and training aids and devices.) If not, in what ways were the materials lacking?

17. Are there any important Trailblazer tasks (operational or maintenance) for which the training materials are less than adequate? If so, what are they?

18. How many of your students were <u>not</u> well prepared for the Trailblazer course this time? (Is this typical? What prerequisites, if any, were lacking?)

19. Which topics of instruction are the most difficult to get across to your students? Why?

20. Were there any particular critical tasks that some of the students found difficult or impossible to master? Why?

21. Following training, what percentage of the students (operators or maintainers, as appropriate) do you think could satisfactorily perform 100 percent of the critical tasks at least 90 percent of the time?

Percentage: [_____]

Your comments or suggestions:

22. Did your students have any significant complaints, comments, or suggestions that you would like to pass along?

23. If you had your way and cost considerations were not a factor, what aspects of the training would you change? Why?

24. Do you think the same training course should take less time? More time? Why?

25. What is the most serious shortcoming associated with Trailblazer training? Why?

26. Are there some good techniques you use that are not a part of the "official" training package that you think ought to be?

27. Would the incorporation of appropriate student performance standards in the training package help to enhance the training effort? Would it help to improve student performance?

28. Would the performance of operators during system setup and tear down procedures be enhanced by incorporating some crew training into the training package--where each student would be provide the opportunity to act as crew chief? Why?

29. Were there any special conditions (environment, maintenance problems, logistics, etc.) associated with the training at Fort Huachuca that caused you to have to deviate from the prescribed training program? If so, please explain.

Section 4: Human Factors--Outside the Shelter

Please make comments and suggestions about each of the following items, as appropriate. (The list is not complete, so there may also be other related items you may wish to comment on.)

In making your comments, consider things like the following:

Things to consider:

Associated maintenance problems	General usefulness
Associated training problems	Labeling
Ease of use	Location
Equipment design as it relates to operator or maintainer performance (i.e., human engineering)	Safety
	Opertor strength, height, etc.

30. VEHICLE LEVELING GAUGES.

31. TSU.

32. TOOLS for outside. (Missing? Special tools required? Too many required? Storage adequacy? Etc.)

33. GROUND ROD DRIVER.

34. GROUNDING STRAPS/CABLES/CLAMPS.

35. 30 KW GENERATOR & ITS CONTROLS.

36. 60 KW GENERATOR & ITS CONTROLS.

37. NOISE LEVELS.

38. POWER CABLE SPOOL.

39. POWER CABLE INSTALLATION. (Operator strength limitations? Design of connectors? Etc.)

40 TAILGATE.

41. HAND HOLDS for climbing onto shelter.

42. EXHAUST PIPE, ENGINE.

43. EXHAUST PIPE, HEATER.

44. WHIP ANTENNAS.

45. MAST TRANSPORT RETAINING FASTENER. (Strength requirements? Ease of operation? Etc.)

46. ANTENNA SHROUD LATCH.

47. BRUSH GUARD RELEASE.

48. CRANK HANDLE FOR ANTENNA GROUP (including shear pin).

49. CRANK HANDLE FOR DIPOLE ELEMENTS.

50. ANTENNA GROUP CLEARANCES when deploying or stowing.

51. DATA LINK ANTENNA ELEMENTS.

52. QUICK-RELEASE PINS (specify which).

53. SADDLE CLAMP SCREWS.

54. ANTENNA HEIGHT LIMITER.

55. MAST CONTROL BOX COVER.

56. MAST CONTROL BOX SWITCHES.

57. MAST ERECTION SWITCH.

58. ANTENNA LEVEL.

59. MAST HYDRAULICS.

60. MAST EXTENSION SWITCH.

61. MAST PNEUMATICS.

62. How well suited is the M1015 vehicle to the Trailblazer system?

Circle one: Very well (1) Well (2) Borderline (3) Poorly (4) Very poorly (5)

Your comments or suggestions:

63. How good is the CPE (collective protection equipment) supplied with the M1015 shelter? What problems, if any, have you experienced or do you anticipate?

Things to consider:

- Weight
- Integrity of seal
- Ease of reach (dust cover zipper, etc.)
- Supporting brackets
- Stability
- Deployment procedures
- Utility & maintenance of dust cover

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

Section 5: Human Factors--Inside the shelter

---

64. AIR CONDITIONER. (Ventilation? Adequate control of temperature? Evenness of air distribution in shelter? Inappropriate use of door for ventilation or temperature control? Adequacy of filters? Problems associated with the outside dust cover? Effect on operator performance? Etc.)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

65. EMERGENCY LIGHT. (Location? Effectiveness? Safety hazard? Etc.)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

66. HEADROOM.

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

67. ADEQUACY OF STORAGE SPACE within shelter. (Storage for manuals & other documents? Other items that would normally be present?)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

68. OPERATOR CHAIRS. (Adequacy for extended shifts? Adjustments? Height? Comfort? Lumbar support? Etc.)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

69. ADEQUACY OF WRITING SURFACES.

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

70. INTERCOM CONTROLS. (Position? Ease of use? Labeling? Etc.)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

71. HEIGHT OF KEYBOARD. (Too high, too low?--specify.)

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

72. KEYBOARD TYPING KEYS. (Location of characters? General feel? Etc.)

Circle one: Very good | Good | Fair | Poor | Very poor
1 2 3 4 5

Your comments or suggestions:

73. KEYBOARD FUNCTION KEYS. (Location? Feel? Etc.)

Circle one: Very good | Good | Fair | Poor | Very poor
1 2 3 4 5

Your comments or suggestions:

74. OPERATOR PANEL. (Problems with the following or other factors: Zeroize, Initialize, BITE, Reload, Master Caution, Call, Preamp, Audio Record, Tone Detector?)

Circle one: Very good | Good | Fair | Poor | Very poor
1 2 3 4 5

Your comments or suggestions:

75. OPERATOR PANEL FOOTSWITCH. (Location? Functioning? Etc.)

Circle one: Very good | Good | Fair | Poor | Very poor
1 2 3 4 5

Your comments or suggestions:

76. AUDIO RECORDER.

Circle one: Very good | Good | Fair | Poor | Very poor
1 2 3 4 5

Your comments or suggestions:

77. AUDIO RECORDER FOOTSWITCH. (Location? Functioning? Etc.)

Circle one: Very good | Good | Fair | Poor | Very poor
1 2 3 4 5

Your comments or suggestions:

78. READABILITY OF PLASMA DISPLAY. (Glare? Clarity of characters? Screen clutter? Etc.)

Circle one: Very good | Good | Fair | Poor | Very poor
1 2 3 4 5

Your comments or suggestions:

79. SPEED OF THE COMPUTER from the operator's point of view.

Circle one: Very fast | Fast | Moderate | Slow | Very slow
1 2 3 4 5

Your comments or suggestions:

80. RECEIVER CONTROL AND DISPLAY UNIT. (Ease of use throughout the operator's duty shift? Design adequacy? Location of controls? Etc.)

Components to consider:

Spectrum display & its controls	POWER RESET button
SPECTRUM WIDTH & ATTEN switches	Elapsed time meter
BFO control & indicator	LAMP TEST button
IF GAIN control	FREQ LOCK button & indicator
Frequency toggle switches & display	POWER switch
RCVR ADDRESS thumbwheels	RCVR MODE push buttons & indicators
Spin dial	Bandwidth switch & display

Overall Rating (if you wish, you may rate individual components in your comments)--

Circle one: Very good (1) Good (2) Fair (3) Poor (4) Very poor (5)

Your comments or suggestions:

Describe any difficulties, problems, or shortcomings associated with the following:

In making your comments, consider things like the following:

Associated maintenance problems	General usefulness
Associated training problems	Labeling
Ease of use	Location
Equipment design as it relates to operator or maintainer performance (i.e., human engineering)	Safety
	Strength requirements

Or any other human factors you consider important.

81. LIGHTS SWITCH. (Location? Etc.)

82. POWER DISTRIBUTION BOX.

83. BREAKER ACCESS PANEL DOOR. (Method of securing? Location a hazard? Etc.)

84. CAUTION PANELS.

85. DMU & HEAD DISK ASSEMBLIES. (Installation? Reliability? Etc.)

86. TSEC/KG-45. (Loading? Zeroing? Finger space? Controls? Etc.)

87. TSEC/KG-84A. (Loading? Zeroing? Finger space? Controls? Etc.)

88. TSEC/KY-57. (Loading? Zeroing? Finger space? Controls? Etc.)

89. VOICE LINK TRANSCEIVER.

90. DATA LINK TRANSCEIVER.

91. REPORTING LINK TRANSCEIVER.

92. RADIO SET CONTROLS for Data & Reporting Link Transceivers. (Ease of use, requirement of screwdriver for setting, labeling, etc.)

Things to consider:

Main power switch	BW/NB/WB switch
CHAN control & indicator	SQ/MN & SQ/GD switches
MANUAL/PRESET/GUARD switch	PRESET frequency display
SQUELCH OFF/ON switch	TONE push button
PRESET push button	VOL control

93. COMMUNICATIONS MODEM.

94. TUNABLE NOTCH FILTER.

95. TUNABLE DIPLEXER.

96. WATTMETER (forward & reverse power).

97. CLOCK.

98. SEARCH RECEIVER.

99. INTERCEPT RECEIVER.

100. What particular controls or indicators do operators (or maintainers) have difficulty identifying (because of location, lack of adequate labeling, infrequency of use, etc.)?

101. Would a list of operator commands placed at a convenient location in front of the operator be a useful addition to the system? In not, why?

Circle one :

No	Probably not	Maybe	Probably yes	Yes
1	2	3	4	5

Your comments or suggestions:

102. Which, if any, aspects of the system are likely to induce operator errors or system failure? (Controls, indicators, lights, design, time constraints, or any other human factors, training factors, safety factors, lack of appropriate support.)

103. Are there any system controls or parts whose accessibility either for operation or maintenance is not satisfactory? (Knobs, switches, cables, connectors, circuitry, etc.) List.

104. What specific system components could be significantly improved with better labeling or identification?

105. What are the most difficult aspects of employing the Trailblazer system?

106. Are there any system components that present significant problems during transport or vehicle movement?

107. What are the most difficult aspects of operating the Trailblazer system?

108. What are the most difficult aspects of maintaining the Trailblazer system?

109. What Trailblazer operational or maintenance problems, if any, have you observed in the past with the use of MOPP gear (level IV)?

Section 6. Safety and Health

Are you aware of any safety or health aspects of Trailblazer that may be hazardous to personnel or have a detrimental effect on system employment or maintenance in an operational environment? Make comments and suggestions for the following, as appropriate.

110. NOISE HAZARDS.

111. CARBON MONOXIDE.

112. HEAD CLEARANCE.

113. CLIMBING SURFACES.

114. HOT OBJECTS.

115. CREW SEAT BELTS.

116. MOVING MACHINERY.

117. ELECTRICAL SHOCK HAZARDS.

118. RF ENERGY.

119. FOOTHOLDS.

120. SHARP OR POINTED OBJECTS.

121. HANDHOLDS.

122. SHOCK HAZARDS.

123. GLARE.

124. LIGHTING ADEQUACY.

125. GROUNDING.

126. SEAT BELTS.

127. GROUND ROD DRIVER.

128. WALKING & CLIMBING SURFACES.

129. WARNING & CAUTIONS IN MANUALS.

130. Overall, how safe is the Trailblazer system to operate (or maintain)?

Circle one: Very safe (1) Safe (2) Borderline (3) Unsafe (4) Very unsafe (5)

Your comments or suggestions:

131. What problems regarding safety or health hazards should be addressed in the operator's (or maintenance) manual but are not?

Operations Trainer Comments & Ratings on Operator Training & Manuals, Safety & Health, & Human Factors

TABLE B-11. (U) OPERATIONS INSTRUCTOR COMMENTS & RATINGS: OPERATOR'S ("10") MANUAL

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
002	3.3	DURABILITY as a field document [33%]: It will start to tear up after 3 or 4 months in field.
011	3.0	ILLUSTRATIONS [33%]: Illustrations tend to be "hypothetical"; they don't always correspond to real world.
004	2.7	TABLES OF CONTENTS [66%]: "Many of operations students have difficulty using table of contents. In order to find out why, I randomly chose items & used table of contents to find them. I encountered no problems." Sometimes specific subjects cannot be found.
006	2.7	READING LEVEL 2.7 [33%]: For some students, trying to operate equipment by following manual was complicated.
007	2.7	LOGICAL FLOW OF MATERIAL throughout manual [33%]: Some things are not in right places.
012	2.7	COMMAND SUMMARY [67%]: "Very helpful."
001	2.3	PHYSICAL SIZE of the manual [0%]
005	2.3	INDEX [67%]: (a) "No problem." (b) Specific topics cannot always be found.
008	2.3	FORMAT [0%]
014	2.3	EASE OF USE by students as a TRAINING document [33%]: Sometimes students cannot find what they are looking for.
015	2.3	EASE OF USE by operators or maintainers as a REFERENCE document [33%]: "Maybe an official abbreviated checklist . . . would help operators."
003	2.0	QUALITY OF REPRODUCTION [0%]
009	2.0	COMPLETENESS [33%]: "[Certain] procedures omitted from 10 manual."
010	2.0	APPROPRIATENESS OF CONTENTS from the user's point of view [0%]
013	n/a	MISTAKES [0%]

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TABLE B-12. (U) OPERATIONS INSTRUCTOR RATINGS & COMMENTS: TRAINING

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
016	n/a	WAS THE ARMY COURSE TRAINING PACKAGE PROVIDED YOU COMPLETE AND ACCURATE IN REGARD TO (A) SYSTEM EMPLOYMENT, (B) SYSTEM OPERATION, AND (C) SYSTEM MAINTENANCE? [33%]: "No, because it is lacking in training material for M1015A & 30 kW generator."
017	n/a	ARE THERE ANY IMPORTANT TRAILBLAZER TASKS (OPERATIONAL OR MAINTENANCE) FOR WHICH THE TRAINING MATERIALS ARE LESS THAN ADEQUATE? [67%]: (a) "Yes"; knowing little of "Military Intelligence, it is very hard to explain to a student who just came out of AIT & language school exactly what [his or her] job is in conjunction with Trailblazer system." (b) "No."
018	n/a	HOW MANY OF YOUR STUDENTS WERE NOT WELL PREPARED FOR THE TRAILBLAZER COURSE THIS TIME? [100%]: (a) "Less than 5%," which is typical. Majority of those not prepared are younger & just out of school. (b) It is "typical" for prerequisites not to be met in "track driving skills [&] PMCS skills for track & generator." An inordinate amount of time required to train students on these tasks.
019	n/a	WHICH TOPICS OF INSTRUCTION ARE THE MOST DIFFICULT TO GET ACROSS TO YOUR STUDENTS? [33%]: "Displaying & accessing LOBs & fixes," because of difficulty of explaining "certain commands & subcommands & their usage."
020	n/a	WERE THERE ANY PARTICULAR CRITICAL TASKS THAT SOME OF THE STUDENTS FOUND DIFFICULT OR IMPOSSIBLE TO MASTER? [67%]: (a) Notion that two operators at a set are operating as a team--that "while one operator is DFing . . . other could [be] gisting." (b) "None."
021	n/a	FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME? [100%]: (a) "70." (b) "90." (c) "100." "Anyone [who] can read & makes [the] effort can perform %100 [sic] all the time!"
022	n/a	DID YOUR STUDENTS HAVE ANY SIGNIFICANT COMPLAINTS, COMMENTS, OR SUGGESTIONS THAT YOU WOULD LIKE TO PASS ALONG? [67%] (a) They noted "equipment failures." (b) "None."
023	n/a	IF YOU HAD YOUR WAY AND COST CONSIDERATIONS WERE NOT A FACTOR, WHAT ASPECTS OF THE TRAINING WOULD YOU CHANGE? [100%]: (a) "Always limit number of students to two per shelter." (b) "CPE: Get rid of it; it's just a waste of time. It takes too long to set up; it's too heavy for vehicle with TSU hooked up; & [I'd] bet my last dollar that it's not guaranteed 100% safe." (c) "None."
024	n/a	DO YOU THINK THE SAME TRAINING COURSE SHOULD TAKE LESS TIME? MORE TIME? [67%]: (a) "Less," because program of instruction that we

TABLE B-12. (U) OPERATIONS INSTRUCTOR RATINGS & COMMENTS: TRAINING (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
		have to follow "tends to drag certain lesson plans." (b) "Varies with students."
025	n/a	WHAT IS THE MOST SERIOUS SHORTCOMING ASSOCIATED WITH TRAILBLAZER TRAINING? [100%]: (a) "Equipment failure." "Training time is seriously impacted when equipment is constantly not operating properly." (b) "Not enough hands on training for instructors."
026	n/a	ARE THERE SOME GOOD TECHNIQUES YOU USE THAT ARE NOT A PART OF THE "OFFICIAL" TRAINING PACKAGE THAT YOU THINK OUGHT TO BE? [67%]: Yes, these people should be thought of as "'human beings' & not just as 'soldiers' or 'students.'" (b) "None."
027	n/a	WOULD THE INCORPORATION OF APPROPRIATE STUDENT PERFORMANCE STANDARDS IN THE TRAINING PACKAGE HELP TO ENHANCE THE TRAINING EFFORT? WOULD IT HELP TO IMPROVE STUDENT PERFORMANCE? [100%]: (a) "Yes, some students need as much motivational help as they can get." Yes, it would both enhance training & improve performance. (b) "No!"
028	n/a	WOULD THE PERFORMANCE OF OPERATORS DURING SYSTEM SETUP AND TEAR DOWN PROCEDURES BE ENHANCED BY INCORPORATING SOME CREW TRAINING INTO THE TRAINING PACKAGE--WHERE EACH STUDENT WOULD BE PROVIDE THE OPPORTUNITY TO ACT AS CREW CHIEF? [100%]: (a) "Yes," experience would be good for them. (b) "Yes," we, ourselves, stress teamwork. (c) "No.!"
029	n/a	WERE THERE ANY SPECIAL CONDITIONS (ENVIRONMENT, MAINTENANCE PROBLEMS, LOGISTICS, ETC.) ASSOCIATED WITH THE TRAINING AT FORT HUACHUCA THAT CAUSED YOU TO HAVE TO DEVIATE FROM THE PRESCRIBED TRAINING PROGRAM? [100%]: "Yes," equipment failures. Continuous equipment maintenance required.

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TABLE B-13. (U) OPERATIONS INSTRUCTOR COMMENTS: HUMAN FACTORS--OUTSIDE THE SHELTER

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
063	5.0	HOW GOOD IS THE CPE (COLLECTIVE PROTECTION EQUIPMENT) SUPPLIED WITH THE M1015A SHELTER? WHAT PROBLEMS, IF ANY, HAVE YOU EXPERIENCED OR DO YOU ANTICIPATE? [100%]: "You don't need it because about same time that it takes to set it up is time it takes to die from chemical or biological agents." "There is no integrity of seal whatsoever! It requires far too much time to deploy." In four fieldings, "have not seen a real working CPE. Seal around door will not seal."
062	3.7	HOW WELL SUITED IS THE M1015A VEHICLE TO THE TRAILBLAZER SYSTEM? [67%]: "Vehicle is too light to handle shelter & CPE's weight & to pull TSU." "In my opinion entire system survivability is almost non-existent in this sort of deployment!"
030	n/a	VEHICLE LEVELING GAUGES [67%]: (a) Front gauge is a safety hazard because you have to climb up vehicle to read it. (b) "Ok."
031	n/a	TSU [67%]: (a) Safety hazard: Potential "serious injury or death" could result from "electrical shock" or from accident while maneuvering TSU. (b) "Ok."
032	n/a	TOOLS for outside [67%]: "Adequate."
033	n/a	GROUND ROD DRIVER [100%]: (a) Unreliable. (b) Winch handle can be a safety hazard--operator must stay clear.
034	n/a	GROUNDING STRAPS/CABLES/CLAMPS [67%]: "Adequate."
035	n/a	30 KW GENERATOR & ITS CONTROLS [67%]: (a) Safety hazard: Vehicle has a "tendency to jump out of gear," which could cause death. (b) Hearing protection required. (c) "Ok."
036	n/a	60 KW GENERATOR & ITS CONTROLS [33%]: "Ok."
037	n/a	NOISE LEVELS [33%]: "Very intense."
038	n/a	POWER CABLE SPOOL [67%]: "Adequate."
039	n/a	POWER CABLE INSTALLATION [100%]: (a) Requires two persons. (b) "Ok."
040	n/a	TAILGATE [67%]: (a) "A two-man lift." (b) "Ok."
041	n/a	HANDHOLDS for climbing onto shelter [100%]: (a) "Very dangerous" situation. "Definitely insufficient." (b) "Ok."
042	n/a	EXHAUST PIPE, ENGINE [33%]: Burn hazard; possible tendency to use as a handhold when hot.

TABLE B-13. (U) OPERATIONS INSTRUCTOR COMMENTS: HUMAN FACTORS-- OUTSIDE THE ~~SHELTER~~ (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
043	n/a	EXHAUST PIPE, HEATER [33%]: Burn hazard; affords a tempting handhold.
044	n/a	WHIP ANTENNAS [33%]: Requires caution while climbing on vehicle.
045	n/a	MAST TRANSPORT RETAINING FASTENER [33%]: Some are very difficult to release.
046	n/a	ANTENNA SHROUD LATCH [67%]: (a) "Despite directions plate, many people have fits with this latch." (b) Sometimes connecting rods do not properly release latch hooks.
047	n/a	BRUSH GUARD RELEASE [33%]: "Sometimes . . . hard to pull & lock in place."
048	n/a	CRANK HANDLE FOR ANTENNA GROUP (including shear pin) [0%]
049	n/a	CRANK HANDLE FOR DIPOLE ELEMENTS [33%]: Caution must be exercised because it is necessary for some to stand on cab frame to reach handle.
050	n/a	ANTENNA GROUP CLEARANCES when deploying or stowing [0%]
051	n/a	DATA LINK ANTENNA ELEMENTS [67%]: (a) Tend to break. (b) "Ok."
052	n/a	QUICK-RELEASE PINS [67%]: (a) Antenna height limiter pin is sometimes difficult to remove & replace. (b) "Ok."
053	n/a	SADDLE CLAMP SCREWS [67%]: "Adequate."
054	n/a	ANTENNA HEIGHT LIMITER [33%]: "Ok."
055	n/a	MAST CONTROL BOX COVER [67%]: "Ok."
056	n/a	MAST CONTROL BOX SWITCHES [67%]: "Adequate."
057	n/a	MAST ERECTION SWITCH [67%]: "Adequate."
058	n/a	ANTENNA LEVEL [33%]: "Ok."
059	n/a	MAST HYDRAULICS [33%]: "Ok."
060	n/a	MAST EXTENSION SWITCH [67%]: (a) Mast sometimes does not retract fully before it is lowered. (b) "Ok."
061	n/a	MAST PNEUMATICS [33%]: "Ok."

TABLE B-14. (U) OPERATIONS INSTRUCTOR RATINGS & COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
101	4.0	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? [0%]
079	3.7	SPEED OF THE COMPUTER from the operator's point of view [33%]: "If you [type at] 35 wpm & above, computer cannot keep up, & if both operators are typing at same time & [at] same moderate speed, it will lock up one or both operator positions."
067	3.3	ADEQUACY OF STORAGE SPACE within shelter [67%]: Fair to poor; inadequate for manuals.
075	3.0	OPERATOR PANEL FOOTSWITCH [33%]: "Sometimes footswitch seems to short out when making radio transmissions."
076	3.0	AUDIO RECORDER [33%]: "It is very difficult to get proper volume for operator messages."
077	3.0	AUDIO RECORDER FOOTSWITCH [0%]
065	2.7	EMERGENCY LIGHT [67%]: "I have actually been driven to my knees by impacting that thing with my head." Unless your 5'3" or below, you'll come back from field "missing some thoughts."
066	2.7	HEADROOM [67%]: (a) "I am 6'2", and, as third person [instructor] on set, I constantly suffer from neckaches." (b) Personnel bump their heads on emergency light [see also item 065].
068	2.7	OPERATOR CHAIRS [0%]
070	2.7	INTERCOM CONTROLS [0%]
078	2.7	READABILITY OF PLASMA DISPLAY [0%]
080	2.7	RECEIVER CONTROL AND DISPLAY UNIT [33%]: "Spectrum display is not adequate enough to even warrant its existence."
069	2.3	ADEQUACY OF WRITING SURFACES [33%]: Writing surfaces are "very small," but there is no space available to enlarge them.
072	2.3	KEYBOARD TYPING KEYS [0%]
073	2.3	KEYBOARD FUNCTION KEYS [0%]
074	2.3	OPERATOR PANEL [0%]
064	2.0	AIR CONDITIONER [0%]
071	2.0	HEIGHT OF KEYBOARD [0%]

TABLE B-14. (U) OPERATIONS INSTRUCTOR RATINGS & COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
081	n/a	LIGHTS SWITCH [67%]: "Adequate."
082	n/a	POWER DISTRIBUTION BOX [67%]: "There ought to be a set sequence of power-up/power-down procedures."
083	n/a	BREAKER ACCESS PANEL DOOR [67%]: "Adequate."
084	n/a	CAUTION PANELS [67%]: "Adequate."
085	n/a	DMU & HEAD DISK ASSEMBLIES [67%]: (a) "DMU's that system uses, that were manufactured by ESL, are a piece of _ _ _ _ !!" (b) "Ok."
086	n/a	TSEC/KG-45 [67%]: "Sometimes it does not take a fill." "Partial load problems."
087	n/a	TSEC/KG-84A [67%]: "No problems."
088	n/a	TSEC/KY-57 [67%]: "Adequate."
089	n/a	VOICE LINK TRANSCEIVER [67%]: "Dinosaur." "Need new, up-to-date equipment."
090	n/a	DATA LINK TRANSCEIVER [67%]: "Adequate."
091	n/a	REPORTING LINK TRANSCEIVER [67%]: "Adequate."
092	n/a	RADIO SET CONTROLS for Data & Reporting Link Transceivers [33%]: "Ok."
093	n/a	COMMUNICATIONS MODEM [33%]: "Ok."
094	n/a	TUNABLE NOTCH FILTER [33%]: "Ok."
095	n/a	TUNABLE DIPLEXER [33%]: "Ok."
096	n/a	WATTMETER (forward & reverse power) [33%]: "Ok."
097	n/a	CLOCK [33%]: "Ok."
098	n/a	SEARCH RECEIVER [33%]: "Ok."
099	n/a	INTERCEPT RECEIVER [33%]: "Ok."
100	n/a	WHAT PARTICULAR CONTROLS OR INDICATORS DO OPERATORS (OR MAINTAINERS) HAVE DIFFICULTY IDENTIFYING (BECAUSE OF LOCATION, LACK OF ADEQUATE LABELING, INFREQUENCY OF USE, ETC.)? [67%]: (a) "Ones on RCDU, because they are seldom used." (b) "None."

TABLE B-14. (U) OPERATIONS INSTRUCTOR RATINGS & COMMENTS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
102	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? [67%]: "Lack of appropriate support." (b) "None."
103	n/a	ARE THERE ANY SYSTEM CONTROLS OR PARTS WHOSE ACCESSIBILITY EITHER FOR OPERATION OR MAINTENANCE IS NOT SATISFACTORY? [33%]: "None."
104	n/a	WHAT SPECIFIC SYSTEM COMPONENTS COULD BE SIGNIFICANTLY IMPROVED WITH BETTER LABELING OR IDENTIFICATION? [33%]: "None."
105	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF EMPLOYING THE TRAILBLAZER SYSTEM? [33%]: "Tracks & weight that must be transported."
106	n/a	ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [33%]: "None."
107	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF OPERATING THE TRAILBLAZER SYSTEM? [33%]: "None."
108	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF MAINTAINING THE TRAILBLAZER SYSTEM? [0%]
109	n/a	WHAT TRAILBLAZER OPERATIONAL OR MAINTENANCE PROBLEMS, IF ANY, HAVE YOU OBSERVED IN THE PAST WITH THE USE OF MOPP GEAR (LEVEL IV)? [0%]

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TABLE B-15. (U) OPERATIONS INSTRUCTOR COMMENTS: SAFETY & HEALTH

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
130	2.0	OVERALL, HOW SAFE IS THE TRAILBLAZER SYSTEM TO OPERATE (OR MAINTAIN)? [0%]
110	n/a	NOISE HAZARDS [67%]: (a) Ensure soldiers always wear hearing protection around vehicle or generators." (b) "Inside noise."
111	n/a	CARBON MONOXIDE [33%]: No problems.
112	n/a	HEAD CLEARANCE [100%]: (a) A problem inside, "especially at entrance of shelter." Lack of head room inside. "Neckaches." (b) Emergency light is hazardous; personnel bump their heads on it.
113	n/a	CLIMBING SURFACES [100%]: (a) "Have to be very careful." (b) "Inadequate handholds." (c) No problems.
114	n/a	HOT OBJECTS [33%]: "Be careful of exhaust pipes if vehicle/heater has been running."
115	n/a	CREW SEAT BELTS [33%]: "Need replacing."
116	n/a	MOVING MACHINERY [33%]: No problems.
117	n/a	ELECTRICAL SHOCK HAZARDS [33%]: No problems.
118	n/a	RF ENERGY [33%]: No problems.
119	n/a	FOOTHOLDS [67%]: (a) "Inadequate." (b) No problems.
120	n/a	SHARP OR POINTED OBJECTS [33%]: No problems.
121	n/a	HANDHOLDS [67%]: (a) "Inadequate." (b) No problems.
122	n/a	SHOCK HAZARDS [33%]: No problems.
123	n/a	GLARE [33%]: No problems.
124	n/a	LIGHTING ADEQUACY [33%]: No problems.
125	n/a	GROUNDING [33%]: No problems.
126	n/a	SEAT BELTS [33%]: No problems.
127	n/a	GROUND ROD DRIVER [33%]: "Doesn't work on most sets, & if it does it takes forever."
128	n/a	WALKING & CLIMBING SURFACES [33%]: No problems.
129	n/a	WARNINGS & CAUTIONS IN MANUALS [33%]: "Sufficient."

TABLE B-15. (U) OPERATIONS INSTRUCTOR RATINGS & COMMENTS: SAFETY & HEALTH (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
131	n/a	WHAT PROBLEMS REGARDING SAFETY OR HEALTH HAZARDS SHOULD BE ADDRESSED IN THE OPERATOR'S (OR MAINTENANCE) MANUAL BUT ARE NOT? [33%]: No problems.

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Maintenance Trainer Comments & Ratings on Maintenance Training & Manuals, Safety & Health, & Human Factors

TABLE B-16. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: MAINTENANCE ("20") MANUAL

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
003	3.0	QUALITY OF REPRODUCTION [33%]: "Poor."
002	2.7	DURABILITY as a field document [67%]: Fold outs "get ripped out too easily." Ringbinder holes in pages should be reinforced or stronger page material used. "Air Force uses paper that is almost like plastic." Fine; will hold up if appropriate binding is used.
009	2.7	COMPLETENESS [33%]: "Block diagrams, wiring diagrams have mistakes."
012	2.7	COMMAND SUMMARY [0%]
010	2.3	APPROPRIATENESS OF CONTENTS from the user's point of view [33%]: All material useful at times. "I like the way it is presented."
011	2.3	ILLUSTRATIONS [33%]: Are in proper places; very helpful.
001	2.3	PHYSICAL SIZE of the manual [33%]: Okay.
007	2.3	LOGICAL FLOW OF MATERIAL throughout manual [33%]: Most materials very well placed. "Only minor problems.
004	2.0	TABLES OF CONTENTS [33%]: "No problem."
006	2.0	READING LEVEL [33%]: Good; matches expertise & background of students.
008	2.0	FORMAT [0%]
005	2.0	INDEX [33%]: "No problem."
014	2.0	EASE OF USE by students as a TRAINING document [33%]: "Information [in] manuals is all good," but manual's bulkiness makes it hard for students to work with it in crowded quarters.
015	1.7	EASE OF USE by operators or maintainers as a REFERENCE document [33%]: "References are good."
013	n/a	MISTAKES [100%]: (a) "Submitted to Vint Hill [project manager]." (b) Have noted a very few "typing or editing" errors of "no consequence." However, official changes we receive look like "rush jobs"--"for example, Change 1 to TM 32-5811-902-10, Appendix E, 'Error and Informational Messages,' has ink smears so bad you have problems reading it."

TABLE B-17. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: TRAINING

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
016	n/a	WAS THE ARMY COURSE TRAINING PACKAGE PROVIDED YOU COMPLETE AND ACCURATE IN REGARD TO (A) SYSTEM EMPLOYMENT, (B) SYSTEM OPERATION, AND (C) SYSTEM MAINTENANCE? [100%]: (a) "Yes." (b) "Adequate." Not enough manuals for M1015A, 30 kW generator, or TSU."
017	n/a	ARE THERE ANY IMPORTANT TRAILBLAZER TASKS (OPERATIONAL OR MAINTENANCE) FOR WHICH THE TRAINING MATERIALS ARE LESS THAN ADEQUATE? [100%]: "No." "Adequate."
018	n/a	HOW MANY OF YOUR STUDENTS WERE NOT WELL PREPARED FOR THE TRAILBLAZER COURSE THIS TIME? [100%]: "None." But "this was not a typical class . . . . They were very experienced . . . . Usually we have young troops."
019	n/a	WHICH TOPICS OF INSTRUCTION ARE THE MOST DIFFICULT TO GET ACROSS TO YOUR STUDENTS? [100%]: "None." Some just require more time than others.
020	n/a	WERE THERE ANY PARTICULAR CRITICAL TASKS THAT SOME OF THE STUDENTS FOUND DIFFICULT OR IMPOSSIBLE TO MASTER? [100%]: "No."
021	n/a	FOLLOWING TRAINING, WHAT PERCENTAGE OF THE STUDENTS (OPERATORS OR MAINTAINERS, AS APPROPRIATE) DO YOU THINK COULD SATISFACTORILY PERFORM 100 PERCENT OF THE CRITICAL TASKS AT LEAST 90 PERCENT OF THE TIME? [100%]: (a) "85," based on experience. "An 'old head' should do much better, maybe 95%". (b) "100." (c) "100."
022	n/a	DID YOUR STUDENTS HAVE ANY SIGNIFICANT COMPLAINTS, COMMENTS, OR SUGGESTIONS THAT YOU WOULD LIKE TO PASS ALONG? [100%]: "Most common complaint among maintenance students is that there is too much emphasis on operations & not enough time for maintenance theory & practical [exercise]." (b) "No."
023	n/a	IF YOU HAD YOUR WAY AND COST CONSIDERATIONS WERE NOT A FACTOR, WHAT ASPECTS OF THE TRAINING WOULD YOU CHANGE? [100%]: (a) Maintenance lesson plans: "too repetitious"; "difficult to keep track of"; "quiz after every block is ridiculous & students don't like them anymore than I do." (b) "Amount of hands-on time should be increased." (c) "No."
024	n/a	DO YOU THINK THE SAME TRAINING COURSE SHOULD TAKE LESS TIME? MORE TIME? [100%]: (a) Total length about right. (b) Devote smaller proportion to operations & larger proportion to maintenance.
025	n/a	WHAT IS THE MOST SERIOUS SHORTCOMING ASSOCIATED WITH TRAILBLAZER TRAINING? [100%]: (a) "Availability of equipment: Support packages are inadequate." "Frequent equipment failure causes training down time." When an operator training set breaks down, maintenance training set is given up to operator training.

TABLE B-17. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: TRAINING (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
		(b) "Inadequate training space: On all fieldings we have been on, maintenance classroom training space has been makeshift (except at Fort Devens)." (c) "Army interference--[soldier] duties; lack of local support."
026	n/a	ARE THERE SOME GOOD TECHNIQUES YOU USE THAT ARE NOT A PART OF THE "OFFICIAL" TRAINING PACKAGE THAT YOU THINK OUGHT TO BE? [100%]: (a) "No." (b) "We are giving 'straight skinny'; let's continue with that."
027	n/a	WOULD THE INCORPORATION OF APPROPRIATE STUDENT PERFORMANCE STANDARDS IN THE TRAINING PACKAGE HELP TO ENHANCE THE TRAINING EFFORT? WOULD IT HELP TO IMPROVE STUDENT PERFORMANCE? [100%]: (a) Probably wouldn't hurt anything; let's try it. (b) "Perhaps." (c) "No."
028	n/a	[Not applicable to maintenance training.]
029	n/a	WERE THERE ANY SPECIAL CONDITIONS (ENVIRONMENT, MAINTENANCE PROBLEMS, LOGISTICS, ETC.) ASSOCIATED WITH THE TRAINING AT FORT HUACHUCA THAT CAUSED YOU TO HAVE TO DEVIATE FROM THE PRESCRIBED TRAINING PROGRAM? [100%--see comment at end of paragraph] "Yes, as always, maintenance course had to be juggled around to match availability of equipment & systems to train on." Yes, "usual equipment failures (air conditioning, TSU, etc.)." [The third respondent, who had not been at Fort Huachuca, said: "No, for Camp Casey, Korea."]

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TABLE B-18. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: HUMAN FACTORS--OUTSIDE THE SHELTER

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
063	3.5	HOW GOOD IS THE CPE (COLLECTIVE PROTECTION EQUIPMENT) SUPPLIED WITH THE M1015A SHELTER? WHAT PROBLEMS, IF ANY, HAVE YOU EXPERIENCED OR DO YOU ANTICIPATE? [33%] "I have been associated [with] or working on this system for past two years & have not seen it work properly yet. System is too heavy, too bulky, will not seal properly; zippers, hose connections, electrical connections are all hard to get to. I don't trust support brackets, because we had one break while one of our people was standing on platform."
062	2.7	HOW WELL SUITED IS THE M1015A VEHICLE TO THE TRAILBLAZER SYSTEM? [33%]: "Too slow, too many mechanical failures, too heavy."
030	n/a	VEHICLE LEVELING GAUGES [100%]: (a) Gauges should be lower, so personnel do not have to climb on vehicle to read them. (b) "Ok."
031	n/a	TSU [100%]: Requires frequent maintenance. "Generator frequently poorly maintained."
032	n/a	TOOLS for outside [100%]: (a) Adequate when present, but set is not complete. Inventory control is needed. (b) "Ok."
033	n/a	GROUND ROD DRIVER [100%]: "Usually inoperable." "Dangerous." "Store in a room with CPE [see item 63]. Worthless!!!"
034	n/a	GROUNDING STRAPS/CABLES/CLAMPS [100%]: (a) Spring-loaded, spool type of strap (like those used with aircraft) would be a time saver. (b) "Ok."
035	n/a	30 KW GENERATOR & ITS CONTROLS [100%]: "Works fine" with "regular servicing & timely maintenance." "Ok."
036	n/a	60 KW GENERATOR & ITS CONTROLS [100%]: As for 30 kW, okay with proper care. "Ok."
037	n/a	NOISE LEVELS [100%]: "Critical safety hazard," which tends to be ignored by many. "Too high." "Very high," especially 60 kW." "High for both generators."
038	n/a	POWER CABLE SPOOL [100%]: (a) Needs regular service. (b) "Ok."
039	n/a	POWER CABLE INSTALLATION [100%]: (a) Too difficult for small soldiers. If three-person team were all slight of build, they might have to spend an inordinate amount of time installing it. (b) "Ok."
040	n/a	TAILGATE [100%]: (a) "Too susceptible to damage." (b) "No problem."

TABLE B-18. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: HUMAN FACTORS--OUTSIDE THE SHELTER (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
041	n/a	HANDHOLDS for climbing onto shelter [100%]: (a) "Not enough." (b) "A few more would be nice, but this is not a problem."
042	n/a	EXHAUST PIPE, ENGINE [100%]: (a) With their protective screens, there is "little danger of getting burns." Need to be "clearly marked for safety." (b) Its location competes with that for operating or maintaining mast systems. (c) "Ok."
043	n/a	EXHAUST PIPE, HEATER [67%]: (a) No problem if clearly marked for safety. (b) "Ok."
044	n/a	WHIP ANTENNAS [100%]: (a) "Eventually somebody is going to get hurt from falling. (b) A handhold should be installed to prevent voice link mast mount from being used instead. (c) "Ok."
045	n/a	MAST TRANSPORT RETAINING FASTENER [100%]: (a) "Poorly designed." When deploying or stowing, weight of antenna group makes retainer hard to operate. (b) "Ok."
046	n/a	ANTENNA SHROUD LATCH [100%]: (a) "Sometimes hard to operate." (b) Needs regular service, "otherwise no problem."
047	n/a	BRUSH GUARD RELEASE [100%]: (a) "Sometimes hard to operate." (b) No problem if regularly serviced.
048	n/a	CRANK HANDLE FOR ANTENNA GROUP (including shear pin) [100%]: (a) "Too susceptible to damage." (b) No problems.
049	n/a	CRANK HANDLE FOR DIPOLE ELEMENTS [100%]: (a) Mechanism has no stop; internal damage can occur if handle is cranked too far. (b) Operator has to stand on cab [frame] in order to reach it.
050	n/a	ANTENNA GROUP CLEARANCES when deploying or stowing [100%]: "No problem."
051	n/a	DATA LINK ANTENNA ELEMENTS [75%]: (a) "Fall out too easily." (b) "Ok."
052	n/a	QUICK-RELEASE PINS [67%]: "Ok."
053	n/a	SADDLE CLAMP SCREWS [67%]: "Ok."
054	n/a	ANTENNA HEIGHT LIMITER [67%]: "Ok."
055	n/a	MAST CONTROL BOX COVER [67%]: "Ok."
056	n/a	MAST CONTROL BOX SWITCHES [67%]: "Ok."

TABLE B-18. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: HUMAN FACTORS-- OUTSIDE THE SHELTER (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
057	n/a	MAST ERECTION SWITCH [67%]: "Ok."
058	n/a	ANTENNA LEVEL [67%]: "Ok."
059	n/a	MAST HYDRAULICS [67%]: "Ok."
060	n/a	MAST EXTENSION SWITCH [67%]: "Ok."
061	n/a	MAST PNEUMATICS [67%]: "Ok."

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TABLE B-19. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: HUMAN FACTORS--INSIDE THE SHELTER

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
065	5.0	EMERGENCY LIGHT [100%]: Location is a safety hazard. "It should be on wall or forward bulkhead."
101	3.7	WOULD A LIST OF OPERATOR COMMANDS PLACED AT A CONVENIENT LOCATION IN FRONT OF THE OPERATOR BE A USEFUL ADDITION TO THE SYSTEM? [0%]
066	3.3	HEADROOM [33%]: This should have been considered "before deciding on this shelter."
080	3.3	RECEIVER CONTROL AND DISPLAY UNIT [100%]: (a) "RCDU is an adequate receiver, but SDU is not considered an effective aid to operator." "Spectrum display unit is really useless for Trailblazer." "Very poor." "Too slow; rarely used." (b) "RCVR ADDRESS thumbwheels are also not used."
067	3.0	ADEQUACY OF STORAGE SPACE within shelter [33%]: "Adequate" for "manuals & other mission documents, but not for anything else."
079	3.0	SPEED OF THE COMPUTER from the operator's point of view [33%]: "Normally speed is ok, but there are times when it does slow you down."
068	2.7	OPERATOR CHAIRS [67%]: (a) "Better if they could swivel." (b) "No problem."
069	2.7	ADEQUACY OF WRITING SURFACES [67%]: (a) Field phone next to position 1 prevents writing shelf for that position from being fully extended. (b) "No problems."
074	2.7	OPERATOR PANEL [33%]: "Caution panel should be lower & between operators so that they might observe a problem before master caution illuminates."
071	2.5	HEIGHT OF KEYBOARD [0%]
076	2.5	AUDIO RECORDER [33%]: "Don't use."
064	2.3	AIR CONDITIONER [33%]: (a) "Shelter is very comfortable when it is working." (b) "Should have no effect on operator performance."
070	2.3	INTERCOM CONTROLS [0%]
072	2.3	KEYBOARD TYPING KEYS [0%]
073	2.3	KEYBOARD FUNCTION KEYS [0%]
075	2.3	OPERATOR PANEL FOOTSWITCH [0%]

TABLE B-19. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
077	2.3	AUDIO RECORDER FOOTSWITCH [0%]
078	2.3	READABILITY OF PLASMA DISPLAY [0%]
081	n/a	LIGHTS SWITCH [100%]: "Ok."
082	n/a	POWER DISTRIBUTION BOX [100%]: "Ok."
083	n/a	BREAKER ACCESS PANEL DOOR [100%]: "Ok."
084	n/a	CAUTION PANELS [100%]: (a) "Should be in a position where both operators could have an eye-level view of them. Maybe switch places with ARC-164 receivers." "Ok," but exchange places with A28/30. (b) "Ok."
085	n/a	DMU & HEAD DISK ASSEMBLIES [100%]: (a) Would be very reliable if power-up & power-off procedures were standardized. Maintenance would be greatly enhanced if reformat/copying procedures were available in field. (b) "Ok."
086	n/a	TSEC/KG-45 [100%]: (a) "Loading KG-45 is one of worst functions operator encounters. It is up too high to get fill cable connected, & finger space is too limited. Maybe if it [were] a little lower, it would not be so awkward to connect fill cable." "Sometimes difficult to fill (load); very common problem for data link not [to be] able to function properly in field. (b) "Ok."
087	n/a	TSEC/KG-84A [100%]: "Ok."
088	n/a	TSEC/KY-57 [100%]: (a) "Same as with KG-45" [see item 086]. (b) "Ok."
089	n/a	VOICE LINK TRANSCEIVER [100%]: "So unreliable, it should be replaced with a more modern transceiver."
090	n/a	DATA LINK TRANSCEIVER [100%]: "Ok."
091	n/a	REPORTING LINK TRANSCEIVER [100%]: "Ok."
092	n/a	RADIO SET CONTROLS for Data & Reporting Link Transceivers [100%]: (a) "Gets job done, [but] there is no requirement or need for preset function." (b) "Ok."
093	n/a	COMMUNICATIONS MODEM [100%]: "Ok."
094	n/a	TUNABLE NOTCH FILTER [100%]: "Ok."
095	n/a	TUNABLE DIPLEXER [100%]: "Ok."

TABLE B-19. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
096	n/a	WATTMETER (forward & reverse power) [100%]: "Ok."
097	n/a	CLOCK [100%]: "Ok."
098	n/a	SEARCH RECEIVER [100%]: "Ok."
099	n/a	INTERCEPT RECEIVER [100%]: "Ok."
100	n/a	WHAT PARTICULAR CONTROLS OR INDICATORS DO OPERATORS (OR MAINTAINERS) HAVE DIFFICULTY IDENTIFYING (BECAUSE OF LOCATION, LACK OF ADEQUATE LABELING, INFREQUENCY OF USE, ETC.)? [100]: (a) [Owing, presumably, to infrequency of use], "most of controls or indicators on SDU of RCDU; especially RCVR ADDRESS thumbwheels." (b) "A36-39 (intercom control, intercom set control); A-95 (in line amplifier; foldout 22, upper right corner). (c) "None."
102	n/a	WHICH, IF ANY, ASPECTS OF THE SYSTEM ARE LIKELY TO INDUCE OPERATOR ERRORS OR SYSTEM FAILURE? [100%]: (A) Operator failure to use proper information & procedures. (b) "None."
103	n/a	ARE THERE ANY SYSTEM CONTROLS OR PARTS WHOSE ACCESSIBILITY EITHER FOR OPERATION OR MAINTENANCE IS NOT SATISFACTORY? [100%]: "None."
104	n/a	WHAT SPECIFIC SYSTEM COMPONENTS COULD BE SIGNIFICANTLY IMPROVED WITH BETTER LABELING OR IDENTIFICATION? [100%]: "None."
105	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF EMPLOYING THE TRAILBLAZER SYSTEM? [100%]: (a) "[Lack of] proper planning & coordination seems to be one of most common problems. You have got to get [system] out on time with everybody on same page & frequency." (b) "Movement," because of particular track vehicle & weight it carries. (c) "Noise." (d) "None."
106	n/a	ARE THERE ANY SYSTEM COMPONENTS THAT PRESENT SIGNIFICANT PROBLEMS DURING TRANSPORT OR VEHICLE MOVEMENT? [100%]: (a) "Brakes on most of TSU's are in questionable condition. Some are unsafe." (b) "Hookups for lights are damaged to point where they don't fit at times." (c) "Pivot steering on many of tracks is unreliable." (d) "Weight, track vehicle [itself], noise."
107	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF OPERATING THE TRAILBLAZER SYSTEM? [100%]: (a) "In many cases it is lack of support. As an example, on Fort Huachuca fielding, two sets assigned to maintenance had to leave doors open during training on set for almost two weeks because light bulbs needed to be replaced--(a ten minute job)." (b) "Weight, track vehicle [itself], noise" [same as item 106]. (c) "None."

TABLE B-19. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: HUMAN FACTORS--INSIDE THE SHELTER (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
108	n/a	WHAT ARE THE MOST DIFFICULT ASPECTS OF MAINTAINING THE TRAILBLAZER SYSTEM? [100%]: (a) "General support (air conditioner, generator, etc.)" (b) "Weight, track vehicle [itself], noise" [same as item 106].
109	n/a	WHAT TRAILBLAZER OPERATIONAL OR MAINTENANCE PROBLEMS, IF ANY, HAVE YOU OBSERVED IN THE PAST WITH THE USE OF MOPP GEAR (LEVEL IV)? [67%] "None."

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TABLE B-20. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: SAFETY & HEALTH

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
130	2.3	OVERALL, HOW SAFE IS THE TRAILBLAZER SYSTEM TO OPERATE (OR MAINTAIN)? [33%]: Would not be a problem if both supervisory personnel & operators observed precautionary measures.
110	n/a	NOISE HAZARDS [100%]: (a) "This is definitely a problem that is not getting enough attention from supervisory personnel. A safety supplement should be developed & incorporated into tech manual that requires hearing protection within a certain limit (20, 25, or 50 feet) of an operating generator, more for 60 kW generator." (b) "TSU." (c) "Yes."
111	n/a	CARBON MONOXIDE [100%]: (a) Proper site setup procedures should be followed. (b) "TSU." (c) "Yes."
112	n/a	HEAD CLEARANCE [100%]: (a) "A definite problem with emergency light." (b) Hazardous when "climbing in."
113	n/a	CLIMBING SURFACES [100%]: (a) "This is a real safety hazard when it is wet." "Poor." (b) No problem.
114	n/a	HOT OBJECTS [100%]: (a) Must use precautions; hazardous after track engine has been in use. (b) No problems.
115	n/a	CREW SEAT BELTS [100%]: (a) "Shoulder harnesses would be an added safety device." (b) "Needed." (c) No problems.
116	n/a	MOVING MACHINERY [100%]: (a) "Track has too many problems." (b) Safety should be emphasized. (c) No problems.
117	n/a	ELECTRICAL SHOCK HAZARDS [100%]: (a) Ensure that power cable is connected before generator is started. (b) No problems.
118	n/a	RF ENERGY [67%]: (a) Stress danger in touching voice link antenna during operations. (b) "Ok."
119	n/a	FOOTHOLDS [67%]: (a) "Not enough." (b) "Ok."
120	n/a	SHARP OR POINTED OBJECTS [100%]: (a) "There is a definite knee hazard on lower position of DMU compartment & [at the] weapons rack." (b) "Too many." (c) No problem.
121	n/a	HANDHOLDS [67%]: (a) "Not enough." (b) No problems.
122	n/a	SHOCK HAZARDS [67%]: (a) "Power distribution panel." (b) "Ok."
123	n/a	GLARE [67%]: No problems.
124	n/a	LIGHTING ADEQUACY [67%]: "Ok."

TABLE B-20. (U) MAINTENANCE INSTRUCTOR COMMENTS & RATINGS: SAFETY & HEALTH (Continued)

No.	Rtg	TOPIC [% responding with comments]: Gist of comments
125	n/a	GROUNDING [100%]: (a) "Reel-out, clamp-on type" of grounding cable "would save much time" [during setup]. (b) "Ok."
126	n/a	SEAT BELTS [100%]: (a) "Need shoulder harness installed." (b) No problems.
127	n/a	GROUND ROD DRIVER [100%]: (a) "Dangerous." (b) "Poor." "Should be eliminated from system."
128	n/a	WALKING & CLIMBING SURFACES [100%]: (a) "Care should be observed when system is wet." (b) "Poor." (c) "Ok."
129	n/a	WARNINGS & CAUTIONS IN MANUALS [100%]: (a) Overall adequate. More explanation would help operator understand consequences of failing to followed prescribed procedures. (b) "Ok."
131	n/a	WHAT PROBLEMS REGARDING SAFETY OR HEALTH HAZARDS SHOULD BE ADDRESSED IN THE OPERATOR'S (OR MAINTENANCE) MANUAL BUT ARE NOT? [100%]: (a) "[Need] more RF energy warnings." (b) Users should follow prescribed procedures. (c) No problems.

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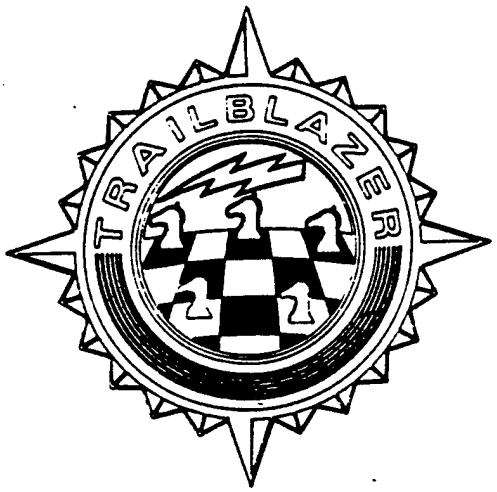

POTOMAC RESEARCH, Incorporated

6121 LINCOLNIA ROAD
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END OF COURSE

QUIZ

END OF COURSE QUIZ

1. What is the purpose of the Directed Search?

   a. To search on a range of frequencies.
   b. To repeatedly look at specific frequencies.
   c. To search for emmiter signals on a specific bandwidth.
   d. It enables the master MCS to direct its' outstations to go to a specific frequency.

2. When setting up your DS Plan, how many frequencies may be assigned a Priority precedence?

   a. 2
   b. 20
   c. 103
   d. 125

3. To remove the activity data from your DS activity files, which command must be entered?

   a. CLEAR
   b. DEACT DS
   c. DSACT
   d. PURGE

4. While developing gist of intercept, how many gist files may be created for each frequency?

   a. 1
   b. 5
   c. Up to 10.
   d. 11

5. While developing a gist message, how many characters may be entered per line?

   a. 5
   b. 21
   c. 72
   d. 440

6. Lines of gist may only be entered when the TEXT= prompt is displayed.

   a. TRUE
   b. FALSE

7. You can execute all commands and edit functions to a gist file only while in the 5-line display mode.

   a. TRUE
   b. FALSE

8. When powering on the MCS, you set all filtered 120/208 VAC circuit breakers to ON in numerical sequence except which one?

   a. CB31
   b. CB18
   c. CB19
   d. 28 VDC MAIN CB

9. While performing a PMCS, you discover a class III leak. What should you do?

   a. No action is required.
   b. This is a deadline item! Notify your supervisor.
   c. Annotate it on your 2404. Keep an eye on your fluid levels and maintain as necessary.
   d. None of the above.

10. When is a PMCS performed on a piece of equipment? (only one answer)

   a. After use.
   b. Before use.
   c. During use.
   d. Any time that piece of equipment is used.

11. A class II leak is a seepage of fluid indicated by discoloration or dampness not great enough to form drops.

   a. TRUE
   b. FALSE

12. What are scratch pad messages?

   a. Personal notes, or comments, that are kept on file in the computer.
   b. Comments and shift change notes imperative to mission accomplishment.
   c. Personal notes or comments that are not kept on file in the computer.
   d. A master station log used to keep track of events that occur during you mission.

13. How many lines of text may be added to a scratch pad file?

   a. 5
   b. 21
   c. 72
   d. 440

14. When parking the M1015, what must the inclinometer, mounted on the front of the shelter read?

a. Zero
b. Plus or minus two of zero.
c. Plus or minus three of zero.
d. Plus or minus four of zero.

15. What clearances, to the side and the front, are required to extend the antenna group horizontally?

a. 20 feet roadside and 30m feet to the front.
b. 30 feet roadside and 20 feet to the front
c. 35 to 40 feet
d. 50 feet.

16. When grounding the Trailblazer system, your grounding rod will not penetrate the surface you have chosen. What should you do next?

a. Nothing, grounding is not really necessary.
b. Pour water on the spot and let it soak for several hours.
c. Place the grounding rod at a 45 deg. angle to change the point of entry.
d. Move the m1015 until you find an area that will accept the grounding rod.

17. In which two places would you find your grounding rods?

a. Inside the M1015 shelter.
b. Inside the TSU storage box.
c. Behind the drivers seat, in the cab of the M1015.
d. Inside the storage box mounted on the front of the M1015.

18. After you have extended the antenna group, what must be done to the shroud prior to raising the mast?

a. It must be closed.
b. It must be opened.
c. It should be folded and stored.
d. Roll it up and fasten to shelter with velcro fasteners.

19. When erecting the mast, what should the level guage, located on the base of the mast, read?

a. Zero
b. Zero plus or minus 2.
c. Zero plus or minus 3
d. 3 plus or minus 1.

20 After the mast has been fully extended, in which position is the mast extension switch placed?

a. IN
b. OUT
c. BOTH
d. PAUSE

21. When developing a GS Plan, how many subbands may be created?

a. 10
b. 15
c. 16
d. 26

22. What are the maximum amount of exclusion frequencies that may be entered into the exclusion frequency list?

a. 120
b. 125
c. 128
d. 130

23. It is not necessary to enter the intermod frequencies into the exlusion frequency list, as this is done automatically by the computer.

a. TRUE
b. FALSE

24. Which command would you use to activate the GS plan?

a. ACTGS
b. GSACT
c. ACT GS
d. GS ACT

25. For safety reasons, what must you ensure prior to installing the voice link antenna?

a. CB31 is off.
b. Voice link transceiver is ON.
c. Voice link transceiver is OFF.
d. Voice link transceiver is tune to proper frequency.

26. During power down procedures, the KG-84A should be left in the STANDBY position.

a. TRUE
b. FALSE

27. During the initialization process, both positions may enter initialization data at the same time.

a. TRUE
b. FALSE

28. Under which circumstances would you enter the antenna orientation on line seven of the intialization screen, page 1?

a. Failed fluxgate.
b. Failed data link.
c. Failed reporting link.
d. Failed voice link transceiver.

29. What is the minimum separation between the data link and reporting link frequencies?

a. 25 KHz
b. 40 KHz
c. 25 MHz
d. 40 MHz

30. How do you exit the initialization process?

a. Enter EXIT.
b. Press INIT key.
c. Enter EXIT INIT.
d. Press the carriage return.

31. Once initiated, what is the only command that will interrupt a BITE test in progress?

a. ABORT
b. EXIT
c. QUIT
d. STOP

32. While performing a BITE test, what is the only indication that the test is in progress?

a. The BITE MENU is displayed.
b. FULL SET BITE screen is displayed.
c. FULL SYSTEM BITE screen is displayed.
d. The BITE-ABORT½ prompt is displayed.

33. Which option number (1-14) would be used to initiate a full system bite?

a. 1
b. 2
c. 13
d. 14

34. In order for the master MCS to run a full system bite test, all of the RMCSs must be in which operating mode?
    a. AUTO
    b. MANUAL
    c. PRE-SET
    d. LOCAL

35. Which option number (1-14) would be used to initiate a full set bite?

    a. 3
    b. 4
    c. 6
    d. 7

36. Which bite test would you use to test your set's data link communicaptions?

    a. SET DF BITE
    b. SET COMM BITE
    c. SET DISK BITE
    d. SYSTEM COMM BITE

37. While powering up the 30KW generator, the starter should not be cranked for more than _____ seconds before allowing the starter cool?

    a. 10
    b. 15
    c. 20
    d. 25

38 While powering down the 30KW generator, it should be allowed to run how long with no load applied?

    a. 2 minutes.
    b. 3 minutes.
    c. 4 minutes.
    d. 5 minutes

39 While setting up the guard receiver, if the frequency is 36.00 MHz, what would the band switch be set to?

    a. A
    b. B

40 While setting up the voice link, you must ensure that the voice link transceiver power is set to high.

    a. TRUE
    b. FALSE

41. In order to check the voice link antenna, you switch the

band switch back and forth from A to B and listen for what sound?

a. A ratchet sound.
b. A short, chirping sound.
c. A high-pitched, wind-up sound.
d. Nothing, this procedure is incorrect.

42. Prior to setting up the data link, what must you ensure has been deactivated?

a. Reporting link.
b. Voice link transceiver.
c. Guard link receiver.
d. General and directed search.

43. The direction (in degrees) from a direction finding set to a target emitter is called:

a. CUT
b. DOV
c. FIX
d. LOB

44. The maximum number of LOBs per LOB set is:

a. 5
b. 8
c. 10
d. 15

45. The default scale for the DF display is:

a. 25 KM
b. 50 KM
c. 100 KM
d. The initialization value.

46. In order to access LOBs for a specific fix, you would:

a. Type ADD, then fix number.
b. Type LOB, then fix number.
c. Type MAN, then fix number.
d. Type SEL, then fix number.

47. Which command would you use in order to return to the initial DF data/fix display and remove all LOBs from the screen?

a. DELETE
b. ERASE
c. REMOVE
d. RESET

48. While installing the head disk assemblies (HDAs), you must

ensure the identification plate is in which position?

a. Up
b. Down
c. Left
d. Right

49. You must ensure that the switch on the rear of the HDA is in which position?

a. WRITE LOCKOUT
b. PROTECT
c. MASTER
d. WRITE

50. During a fluxgate failure, you have decided to take your compass reading from position #6 (ref TM page 2-220). You get a bearing of 110 degrees. What entry would be made on line seven of initialization screen 1?

a. E,155
b. E,335
c. W,155
d. W,25

51 Which two message types are used to transmit fix and/or gist data back to the TCAC?

a. Klieglight and Klieglight-X.
b. Tactical Report and Tech Message.
c. Klieglight and Task Effectiveness Report.
d. Resouce Status Feeder and Resource Tasking Message.

52. If you have a failure on the CPU, the MCS may operate as an RMCS. What is the first step you need to accomplish in order to change the MCS to an RMCs?

a. Turn CB18 and CB31 off.
b. Turn CB18 and CB31 on.
c. Set data disk power switch to OFF.
d. Plug cable W56 into Signal Processor J11.

53. While operating with a failed data link, how is DF information passed back and forth between the Trailblazer sets?

a. Guard Link
b. Reporting Link
c. Tasking Messages
d. Secure Voice Link

54. Which message type is used, by TCAC, in the transmittal of Tasking Messages?

a. Tactical Report Messages
b. By use of the alert status on the message line of plasma display.
c. Resource Status Feeders
d. Resource Tasking Messages

55. What is the maximum number of messages contained in the Transmit Message Directory?

a. 10
b. 17
c. 20
d. 22

56. When the incoming message directory is completely full, what happens to the oldest message when a new message is received?

a. It is automatically sent back to TCAC.
b. It is transferred to the Received Message Directory.
c. It is deleted from the Incoming Message Directory and goes to message heaven.
d. It is deleted from the Incoming Message Directory and is automatically added to the received Message Directory.

57. Which command is used to access the Transmit Message Directory?

a. RPT MSG function key.
b. TASK MSG function key.
c. DIR
d. MESSAGE

59. If you fail this test (highly unlikely), will you?

a. Immediately go AWOL.
b. Throw yourself in front of a speeding bus.
c. Throw your instructor in front of a speeding bus?
d. All of the above.

Trailblazer Operator's Performance Evaluation Checklist

TRAILBLAZER OPERATOR'S PERFORMANCE EVALUATION

Student name:_____

Unit:_____

Evaluator:_____

Date:_____

I. ASSEMBLY AND PREPARATION FOR USE	GO	NO-GO
1. DETERMINE OF SITE LAYOUT.	( )	( )
2. PARK, LEVEL, AND GROUND MCS VEHICLES.		
A. 30 feet clearance roadside and 20 feet clearance at the front of the M1015.	( )	( )
B. TSU Level.	( )	( )
C. MCS parked with nose facing in a cardinal direction.	( )	( )
D. Grounding rod driven, with MCS and TSU attached.	( )	( )
E. Inclinometer on the front of the MCS ±2 deg. of zero, and side reads ±3 deg. of zero.	( )	( )
3. OPEN SHELTER.	( )	( )
4. PREPARE AND CONNECT POWER SOURCE.		
A. Perform PMCS on generator.	( )	( )
B. Connect power cable J11 between TSU and shelter.	( )	( )
5. PREPARE MCS FOR POWER ON.		
A. LIGHTS switches.	( )	( )
B. All filtered 120/208 VAC DISTRIBUTION CBs OFF.	( )	( )
C. 28 VDC MAIN CB in OFF. All other 28 VDC DISTRIBUTION CBs ON.	( )	( )
D. Air Conditioner control switch OFF.	( )	( )

	GO	NO-GO
E. All UNFILTERED 120/208 VAC CBs behind DISTRIBUTION CIRCUIT BREAKER ACCESS DOOR are OFF.	( )	( )
F. Following power switches are ON:		
(1) Audio Recorders	( )	( )
(2) Guard Receiver	( )	( )
(3) Receiver Control Displays	( )	( )
(4) Signal Data Processor	( )	( )
(5) Voice Link Transceiver	( )	( )
(6) Plasma Displays	( )	( )
6. POWER UP SHELTER.		
A. At power source, turn on power.		
(1) START/RUN/STOP switch in the START position. Oil Pressure Guage reads at least 30 PSI.	( )	( )
(2) Circuit breaker switch in the CLOSE position until the circuit breaker indicator lights.	( )	( )
(3) All engine and generator readings observed for proper voltage, oil pressure, frequency, etc.	( )	( )
(4) All CBs behind access panel ON except for equipment not used. Access panel door closed and secure.	( )	( )
B. Verify readings in shelter.	( )	( )
7. SET UP AIR CONDITIONER.	( )	( )
8. INSTALL HEAD DISK ASSEMBLIES (HDAs).	( )	( )
9. POWER ON MCS.		
A. Set switch S4.	( )	( )
B. Set air conditioner controls.	( )	( )
C. All FILTERED 120/208 VAC CBs turned ON in numerical sequence, except CB18.	( )	( )
D. 28 VDC MAIN ON.	( )	( )

	GO	NO-GO
E. RESET/TEST switches on caution panel RESET one at a time.	( )	( )
F. CB18 turned on after RDY 0, RDY 1, and PSOK indicators are lit on the DMU.	( )	( )
H. After system is fully loaded, system up screen appears (Trailblazer LOGO). INIT prompt appears.	( )	( )
10. DEPLOY WHIP ANTENNAS.	( )	( )
11. DEPLOY ANTENNA GROUP AND RAISE MAST.	( )	( )
12. INITIALIZE THE MCS - Make appropriate entries to the Local, Network, and RDLS parameters screens.	( )	( )
13. SET UP VOICE LINK.	( )	( )
14. SET UP GUARD RECEIVER.	( )	( )
15. SET UP DATA LINK.	( )	( )
16. SET UP REPORTING LINK.	( )	( )
17. PERFORM BITE.	( )	( )

II. SYSTEM OPERATION

1. DETERMINE SET AND SYSTEM STATUS.	( )	( )
2. PERFORM A GENERAL SEARCH.		
A. Set Up A General Search Plan.	( )	( )
B. Edit the GS Plan.	( )	( )
C. Develop Exclusion Frequency List.	( )	( )
D. Activate GS.	( )	( )
E. Deactivate GS.	( )	( )
F. Access all GS activity data.	( )	( )
H. Access GS Histogram.	( )	( )
I. Access GS activity by restrictive parameters.	( )	( )

	GO	NO-GO
3. PERFORM A DIRECTED SEARCH.		
A. Set Up The DS Plan.	( )	( )
B. Edit DS Plan.	( )	( )
C. Activate DS.	( )	( )
D. Deactivate DS.	( )	( )
E. Clear DS activity.	( )	( )
F. Access DS Activity Data.	( )	( )
4. INTERCEPT AND MONITER HF SIGNALS.	( )	( )
5. INTERCEPT AND MONITOR VHF/UHF SIGNALS.	( )	( )
6. INITIATE DF REQUEST.	( )	( )
7. ACCESS AND EDIT FIX AND LOB DISPLAYS.	( )	( )
8. DEVELOP, DISPLAY AND EDIT GIST.	( )	( )
9. ACCESS DF/GIST DIRECTORY	( )	( )
10. PURGE DF DATA FROM FILE.	( )	( )
11. MISSION TASKING		
A. Access INCOMING MESSAGE DIRECTORY.	( )	( )
B. Access RECEIVED MESSAGE DIRECTORY.	( )	( )
C. Access RELAY MESSAGE DIRECTORY.	( )	( )
D. Access STATION PACKET QUEUE STATUS.	( )	( )
E. Read a message.	( )	( )
F. Delete a message.	( )	( )
G. Update DIRECTED SEARCH and GENERAL SEARCH plans.	( )	( )
12. MISSION REPORTING.		
A. Access TRANSMIT MESSAGE DIRECTORY.	( )	( )
B. Read Message listed in TRANSMIT MESSAGE DIRECTORY.	( )	( )
C. Delete a message from TRANSMIT MESSAGE DIRECTORY.	( )	( )

	GO	NO-GO
D. Send Message.	( )	( )
E. Develop a new message.	( )	( )
F. Use HELP file while developing msg.	( )	( )
G. Send DF/GI information to TCAE in a KLI MSG.	( )	( )
13. DEVELOP, DISPLAY AND EDIT SCRATCH PAD MESSAGES.	( )	( )
14. ACCESS OPERATOR MESSAGES.	( )	( )
15. ACCESS HELP FILE.	( )	( )
16. RECORD AUDIO SIGNALS AND OPERATOR COMMENTS.	( )	( )
17. OPERATE SHELTER TO CAB INTERCOM.	( )	( )
18. OPERATE VOICE LINK.	( )	( )
19. UNUSUAL CONDITIONS		
A. Failed Data Link Operations.	( )	( )
B. Failed Voice Link Antenna Tuning.	( )	( )
C. Failed Function Key Operation.	( )	( )
D. Failed Fluxgate Operations.	( )	( )
E. Convert from MCS to RMCS.	( )	( )

III. SYSTEM SHUT DOWN.

1. ZEROIZE HEAD DISK ASSEMBLIES.	( )	( )
2. ZEROIZE COMSEC EQUIPMENT	( )	( )
3. LOWER MAST AND STOW ANTENNA GROUP.	( )	( )
4. POWER OFF MCS.	( )	( )
5. TURN OFF AND DISCONNECT POWER SOURCE.	( )	( )
6. STOW WHIP ANTENNAS.	( )	( )

	GO	NO-GO
7. DISCONNECT AND REMOVE SHELTER AND TRAILER GROUNDS.	( )	( )
8. CLOSE SHELTER.	( )	( )
9. PREPARE VEHICLES FOR MOVEMENT.	( )	( )

IV. COLLECTIVE PROTECTION EQUIPMENT

1. PERFORM PMCS ON CPE.	( )	( )
2. SET UP EXTERNAL M43A1 DETECTOR UNITS.	( )	( )
3. SET UP CPE.	( )	( )
4. PERFORM CPE FUNCTIONAL TEST.	( )	( )
5. OPERATE CPE.	( )	( )
6. TEAR DOWN AND STOW CPE.	( )	( )